FOREWORD

The Level Crossing Removal Authority (LXRA) was established in 2015 by the Victorian Government to oversee one of the largest rail infrastructure project in the state's history.

Central to the project is the elimination of 50 dangerous and congested level crossings across Melbourne by 2022, and with 12 crossings already removed by January 2018, we've achieved excellent results. In addition to upgrading or building more than 20 train stations, we're laying kilometres of new tracks, improving local travel connections and transforming local community precincts.

Not only are we increasing safety, reducing travel times and congestion for local communities throughout Melbourne, we're also designing our projects with innovation at the forefront.

Our Bayswater project was certified with an independent Infrastructure Sustainability Rating, receiving the highest rating possible and setting a new industry benchmark in sustainable delivery. We've also installed more than 600 solar panels across the new Gardiner, Ormond, McKinnon and Bentleigh train stations, which power key equipment such as ticket machines, lighting and security systems, and offset power usage at other stations along the Frankston Line.

At Edithvale and Bonbeach, we are removing both level crossings using a trench solution, by putting the rail under the road. Undertaking such a significant construction effort in close proximity to the internationally-protected Edithvale-Seaford Wetlands could have an impact on the wetlands, and as a result, the Minister for Planning decided that an Environment Effects Statement (EES) was required to make sure our projects are delivered in such a way as to protect these invaluable environmental assets.

I saw this as a great opportunity for LXRA to work with technical experts and the community to achieve the best possible outcome for the area. The studies and environmental management approach presented in this EES respond to the Scoping Requirements issued by the Minister for Planning. The EES, together with an Inquiry under the *Environment Effects Act 1978* and the final assessment of the environmental effects of the projects by the Minister for Planning, will ensure any possible impacts are identified and managed to keep people and the environment safe.

This EES is the product of a year of hard work from our team at LXRA. We also thank the Department of Environment, Land, Water and Planning and other key stakeholders for their invaluable contribution to the EES process through their involvement their involvement on the Technical Reference Group.

I encourage all members of the community to read this EES and make a submission.

Kevin Devlin
CEO LXRA

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EXECUTIVE SUMMARY

Introduction

The Victorian Government is removing 50 of Victoria's most dangerous and congested level crossings, including the crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach) on the Frankston rail line.

The Frankston rail line serves some of Melbourne's most vital economic centres, as well as vast and growing residential catchments. The corridor currently serves a population of around 250,000 people, which is forecast to grow to around 500,000 people by 2036. It also provides access to the significant industrial precinct and transport gateway at the Port of Hastings, and a key metropolitan activity centre at Frankston. The Frankston Hospital and Monash University campus in Frankston are significant regional employers.

In February 2017, the Victorian Government announced that the level crossings at Edithvale and Bonbeach would be removed by lowering the rail into a trench at each location. New stations would also be built at Edithvale and Bonbeach as part of each project.

On 5 April 2017, the Minister for Planning requested that LXRA prepare an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (EE Act) to assess the potential environmental effects of the projects.

In addition, the Commonwealth Minister for the Environment and Energy determined that the level crossing removal projects at Edithvale and Bonbeach require approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), due to the potential cumulative impact on the internationally-important Edithvale-Seaford Wetlands, listed threatened species and migratory species. This EES also considers the matters of national environmental significance for assessment under that Act.

Investigations conducted for the EES have found that the level crossing works would not directly impact the wetlands. Any other potential impacts are minor and can be managed effectively through the environmental processes.

The projects would be delivered through an Alliance model in which a construction partner works alongside LXRA and Metro Trains Melbourne (MTM) to prepare detailed designs and construct the project, with construction planned to commence in 2019. The level crossing would be removed by 2022.

Once the construction is complete, LXRA would return the finished rail infrastructure to VicTrack, the Victorian Government body which owns Victoria's transport land, assets and infrastructure. Rail operations would be conducted by MTM which would operate the rail line.

Level Crossing Removal Authority

The Level Crossing Removal Authority (LXRA) is an administrative office of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and is one of several Victorian Government agencies delivering its integrated transport policy objectives.

LXRA is responsible for the delivery of the 50 level crossing removals, including the level crossings at Edithvale and Bonbeach, for the Victorian Government.

Specifically, LXRA is responsible for:

- developing the design of the level crossing removal projects
- coordinating technical investigations
- preparing this EES
- engaging and informing stakeholders and the wider community
- obtaining the key planning and environmental approvals
- coordinating procurement activities to appoint a private sector construction partner
- delivering the projects as a member of the construction Alliance
- coordinating the commissioning of the new infrastructure.

The projects

Edithvale level crossing removal project

Location

The level crossing at Edithvale Road is located south of the existing Edithvale Station between Nepean Highway and Station Street. It is approximately 32 kilometres from Flinders Street Station. Edithvale Road runs in an east-west direction between the Nepean Highway and Wells Road, and is a declared arterial road linking Edithvale and surrounding suburbs to the Nepean Highway, the Mornington Peninsula Freeway (M11) and to Melbourne's eastern suburbs via Springvale Road, Eastlink and Westall Road.

The Edithvale project area is located predominantly within the existing rail reserve owned by VicTrack. The rail reserve was established in the early 1880s and has been disturbed by more than a century of rail-related activities.

The Edithvale project area extends from Lincoln Parade, Aspendale to Chelsea Road, Chelsea. It includes the rail corridor and all of Station Street and Nepean Highway to the east and west, and small sections of adjacent road reserves.

Existing pedestrian and cyclist crossings in proximity to the level crossing are located at Lochiel Avenue, Edithvale Road, Denman Avenue, Fraser Avenue and Berry Avenue. No private land would be required for the project.

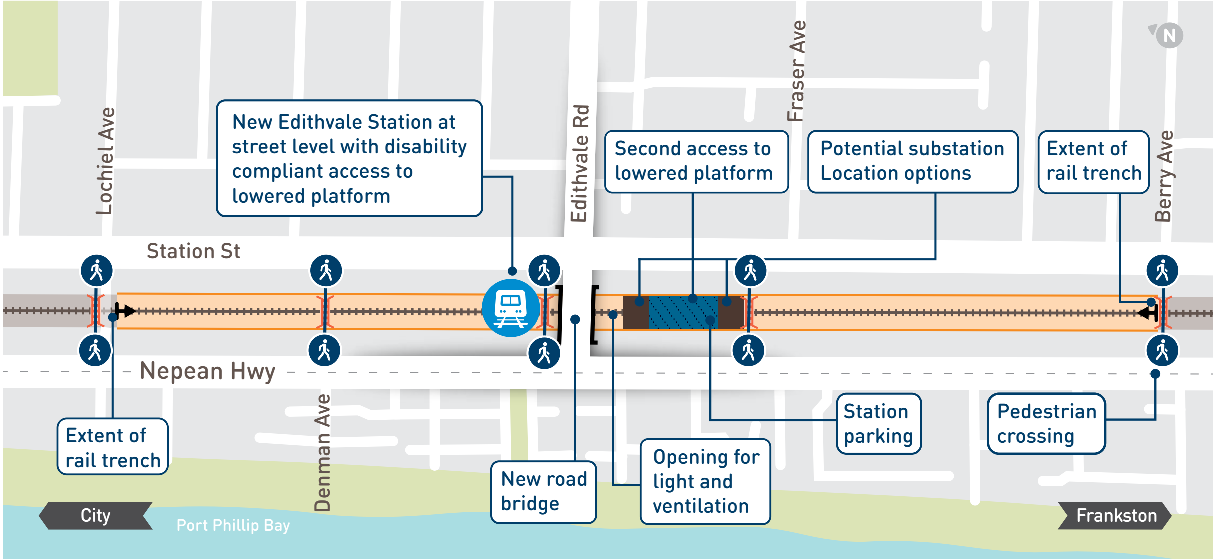
Project description

The Edithvale project involves removing the level crossing by lowering the Frankston rail line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level.

The trench would be constructed between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length, 14 metres wide at the narrowest point, widening up to 24 metres at the new Edithvale Station. The rail track would be approximately eight metres below ground level at its lowest point at Edithvale Station and therefore the maximum depth of excavation would be 14 metres to allow for underground infrastructure (below the rail track) to collect and divert rain water from the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would be required to provide for the new station building, car parking and a substation required to ensure sufficient power is available for passenger services on the Frankston rail line. New pedestrian bridges would be constructed to retain pedestrian access across the rail line. A new station at the same location as the existing station would be constructed with disability compliant access to the below-ground train platforms. Project components are shown schematically in Figure A.

Figure A Schematic design for Edithvale


Lochiel Ave
New Edithvale Station at street level with disability compliant access to lowered platform
Edithvale Rd
Second access to lowered platform
Fraser Ave
Potential substation Location options
Extent of rail trench
Berry Ave
N
Station St
Nepean Hwy
Extent of rail trench
Denman Ave
New road bridge
Opening for light and ventilation
Station parking
Pedestrian crossing
City
Port Phillip Bay
Frankston

Bonbeach level crossing removal project

Location

The level crossing at Station Street/Bondi Road is located south of the Bonbeach Station between Nepean Highway and Station Street. It is approximately 35 kilometres from Flinders Street Station.

The Bonbeach project area is located predominantly within the existing rail reserve owned by VicTrack. The rail reserve was established in the early 1880s and has been disturbed by more than a century of rail-related activities.

The Bonbeach project area extends from Chelsea Road, Chelsea to Patterson River, Bonbeach. It includes the rail corridor and all of Station Street and Nepean Highway located to the east and west, and small sections of adjacent road reserves.

Existing pedestrian and cyclist crossings across the rail corridor are located at Golden Avenue, Wellwood Road, Bondi Road and The Glade.

No private land would be required for the project.

Project description

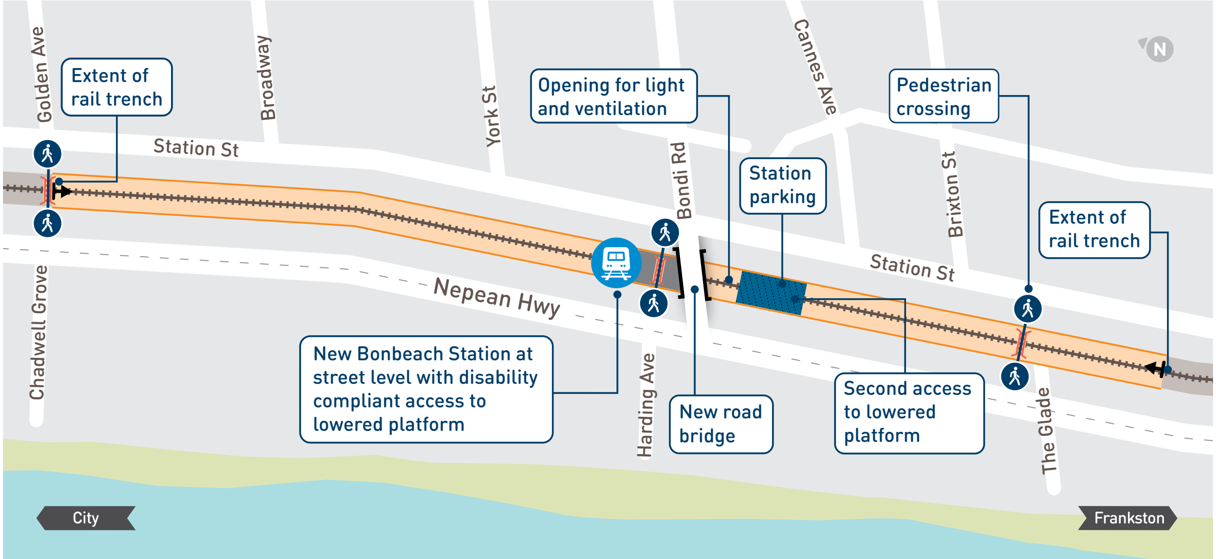
The Bonbeach project involves removing the level crossing by lowering the Frankston rail line into a trench under Bondi Road while maintaining Bondi Road at the current road level.

The trench would be constructed between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening up to 24 metres at the new Bonbeach Station platforms. The rail track would be approximately eight metres below ground level at its lowest point at Bonbeach Station and therefore the maximum depth of excavation would be 14 metres to allow for underground infrastructure (below the rail track) to collect and divert rain water from the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would provide for the new station building and car parking. New pedestrian bridges would be constructed to retain pedestrian access across the rail line. A new station at the same location as the existing station would be constructed with disability compliant access to the below-ground train platforms.

Project components are shown schematically in Figure B.

Figure B Schematic design for Bonbeach



Benefits of the projects

The Edithvale and Bonbeach level crossing removal projects are part of the Victorian Government's Level Crossings Removal Program (LXRP). The objectives of the program, which are consistent with the objectives of the *Transport Integration Act 2010* (TI Act), are to:

- deliver significant safety improvements for drivers, cyclists and pedestrians
- improve travel around the local areas – for train users, pedestrians, cyclists and drivers
- get people home safer and faster
- make our roads more reliable, enabling people to better predict their travel times
- stimulate economic growth by creating jobs during construction
- revitalise local communities, including modernisation of station precincts
- enable more trains to run more often and on time.

Each level crossing removal project contributes to the objectives of the overall LXRP.

The program also includes the Metropolitan Network Modernisation Program improvements (including new train stations, improved public transport access, and new pedestrian and cycling links) and amenity improvements such as landscaping and streetscape improvements.

Within this broader context, the specific objectives of the Edithvale and Bonbeach level crossing removal projects are to:

- improve transport safety in the Edithvale and Bonbeach areas
- reduce traffic congestion in the Edithvale and Bonbeach areas
- generate local jobs and stimulate the local economy
- facilitate additional train services on the Frankston rail line.

The projects also include significant upgrades to the existing Edithvale and Bonbeach stations, which are reaching the end of their intended design life, as well as improvements to public areas around the stations.

The benefits of the removal of the Edithvale and Bonbeach level crossings align with the projects' objectives through:

- eliminating the risk of collision between trains and vehicles, cyclists and pedestrians
- improving amenity at Edithvale and Bonbeach stations, contributing to improved transport safety
- eliminating the traffic delays associated with the level crossings for to the 14,000 vehicles that use the Edithvale level crossing and the 4,500 vehicles that use the Bonbeach level crossing each weekday
- generating hundreds of jobs within the local areas for the duration of the construction program
- facilitating more train services on the Frankston line.

Planning for the Edithvale and Bonbeach level crossing removals

The Edithvale and Bonbeach level crossing removal projects are being assessed under the EE Act, which provides for the assessment of proposed projects in Victoria that could have a significant effect on the environment.

Requirement for an EES

On 5 April 2017, the Minister for Planning determined that an EES was required to inform the Minister's assessment of the potential environmental effects of the projects and the approvals required.

The Minister's reasons for making this decision included that the project works have '*the potential for a range of significant environmental effects*'. In particular, the project would potentially examine effects on:

- The regional groundwater regime resulting in potential changes to hydrological conditions at the Ramsar listed Edithvale-Seaford Wetlands.
- The ecological character and habitat values of the Edithvale-Seaford Wetlands, and the dependent flora and fauna, in particular the critical components of habitat for listed waterbirds, due to alterations in the groundwater regime.
- The protected beneficial uses of groundwater, due to alterations in the groundwater regime, along with risks to human health, recreation and ecosystems due to changes in water quality.

The Minister's decision determined that 'other potential effects on the social or environmental setting are unlikely to be significant and should be readily addressed and mitigated through existing statutory processes' including under the *Environment Protection Act 1970* and *Planning and Environment Act 1987*.

The matters to be investigated and documented in the Edithvale and Bonbeach Level Crossing Removal Project's EES are set out in the 'Scoping Requirements' issued by the Minister in September 2017. These requirements reflect the decision of the Minister for Planning on the need for an EES and identify key issues related to how the trenches could impact on regional groundwater movements and what effect this could have on the Edithvale-Seaford Wetlands, and how the trenches could expose pre-existing contamination and potential acid sulfate soils and possibly affect human health, recreation and ecosystems.

The EES process

An EES is not an approval process. An EES assessment demonstrates the ability of the projects to meet statutory requirements. It provides decision-makers (including Ministers and other statutory authorities) with the information they need to make decisions about whether statutory approvals for the project should be granted and, if so, what conditions should apply.

This EES:

- describes the proposed Edithvale and Bonbeach level crossing removal projects
- describes the existing environment that may be affected by the projects
- identifies the potential effects of the projects on the environment
- recommends ways to avoid, minimise, offset or manage any adverse effects
- proposes an environmental management framework for managing and monitoring potential environmental effects during implementation of the projects.

The EES process is designed to be rigorous and transparent, with opportunities provided for input from stakeholders and the wider community. It includes environmental impact assessments undertaken by 14 technical specialists to ensure the EES addresses the Scoping Requirements set by the Minister for Planning.

The Victorian Government's EES process is accredited to assess impacts on Matters of National Environmental Significance (MNES) under the EPBC Act through the Bilateral (Assessment) Agreement between the Commonwealth and the State of Victoria. This EES therefore also considers Matters of National Environmental Significance.

Environmental Performance Requirements

One of the key outcomes of the EES process is to recommend a set of Environmental Performance Requirements (EPRs). The EPRs define the environmental outcomes that must be achieved during design, construction and operation of the Edithvale and Bonbeach level crossing removal projects regardless of the detailed design solutions adopted. They may also represent the measures developed in this EES to avoid, reduce or offset potential environmental impacts. These measures are not necessarily the only or 'best' means of managing impacts. They are provided as examples to demonstrate that practicable measures are available to achieve the EPR. Under the performance-based approach being adopted for the projects, it would be up to the Alliance to determine how best to achieve the EPRs. The implementation of the Environmental Management Framework (EMF) will provide oversight of the Alliance's achievement of the EPRs.

The 14 technical specialists developed an initial set of EPRs as part of their impact assessments. These assessments evaluated the environmental effects of the projects and the proposed construction methodologies. Through the risk assessment process, the initial set of EPRs was refined to a final set of EPRs that reflect the findings of the impact assessment and the designs.

The approach adopted to develop and refine the EPRs and assess environmental risks and impacts is described in Chapter 4 *Assessment framework*. A full list of the EPRs for the project is set out in Chapter 9 *Environmental Management Framework.*

Potential impacts of the projects

The projects would remove two dangerous and congested level crossings, and contribute to significant improvements in the capacity, efficiency and reliability of the Frankston rail line, and create safer and more vibrant precincts for the two suburbs.

Like all infrastructure projects, their construction and operation would change the local setting and potentially affect the local environment, particularly during construction. The construction activity would be disruptive, particularly to those who live adjacent to the works. However, the disruption would be temporary during which time LXRA would work closely with those affected to ensure a high level of communication is maintained throughout the construction period which would ultimately deliver a high quality urban outcome that creates a much safer environment for residents of, and visitors to, both Edithvale and Bonbeach.

The investigations undertaken for the EES focused primarily on the three potentially significant impacts identified by the Minister for Planning in determining the requirement for an EES. An additional 11 investigations were undertaken to assess potential impacts of each project on all aspects of the environment. This section presents the key findings of those investigations.

The Seaford component of the Edithvale-Seaford Wetlands is over five kilometres from the projects and is separated by Patterson River and Patterson Lakes. These features provide a hydrogeological barrier such that any changes to the regional groundwater regime due to the projects could not affect the Seaford Wetland. The initial groundwater model prepared for the EES predicted that the trench proposed at Edithvale would result in groundwater mounding on the inland side that could potentially increase the frequency of water logging that already occurs on occasion in the Edithvale area. The same impact was not identified at Bonbeach.

In response to the risk of water logging, activation of acid sulfate soils and a potential increase in the salinity of groundwater, an engineering solution was developed to enable groundwater to flow around the trench structure at Edithvale and reduce the potential mounding to within natural variability. The engineering solution was then tested using the groundwater model to confirm it would be effective to reduce groundwater mounding so that it would not result in water logging beyond existing levels and extents.

Groundwater drawdown between the trenches and the coast may affect a small area of coastal vegetation and pre-existing naturally occurring acid sulfate soils, but through implementing the EPRs, beneficial uses of groundwater would not be impacted.

Table A provides a summary of the key findings.

On balance, and in considering these findings, LXRA considers that the three evaluation objectives established by the Scoping Requirements have been met.

Table A Summary of key findings

Topic	Key finding
1. Potential impacts to regional groundwater	The proposed trench at Edithvale has the potential to exacerbate existing water logging as a result of groundwater intersecting with the surface. The project would be designed to avoid this impact and ensure no significant impacts to the environment occur. An engineering solution has been developed and modelled using the independently peer reviewed groundwater model prepared for the EES to demonstrate this outcome is achievable. These potential changes to groundwater have been assessed as minor. Groundwater flows in a different direction at Bonbeach compared to Edithvale and mounding is not predicted to cause water logging at this project.
2. Edithvale Wetland	Given the distances between the Edithvale Wetland and the project sites (1.3 kilometres from the existing Edithvale Road level crossing and two kilometres from Bonbeach level crossing), the works would not directly impact the wetlands through, for example, loss of vegetation or disturbance to bird species. Furthermore, the groundwater modelling predicts that the effect of the trenches on regional groundwater would return to background levels at least one kilometre from the wetlands, such that the hydrological regime and ecological character of the wetlands would not be affected. The Edithvale-Seaford Wetlands would therefore continue to meet the applicable Ramsar listing criteria.
3. Groundwater Dependent Ecosystems (GDEs)	Terrestrial GDEs exist in a naturally variable environment in which water is accessed via the surface or groundwater. Both sources naturally fluctuate based on long-term climatic conditions and the prevailing weather and as such terrestrial GDEs must be adaptable and resilient to these variable conditions. Given the small change in groundwater predicted through the model it is likely changes to vegetation will be minor or negligible.
4. Native vegetation	Native vegetation is present within the rail corridor and would be removed to enable construction of the proposed rail trenches. Conservatively assuming that both project areas would be cleared of all vegetation, the area of affected native vegetation would total 2.2 hectares. This would be substantially minimised in finalising project designs and construction methodologies, clearing only what is necessary, and offsetting the impacted vegetation in accordance with Victorian Government policy.
5. Acid sulfate soils and contamination	The projects would prevent adverse environmental or health effects from disturbing, storing or influencing the movement of contaminated or acid-forming material, and be designed to protect beneficial uses. Excavation of material that is likely to be contaminated would be unavoidable, however implementation of well-defined and established practices to manage environmental and human health risks would be implemented. The overall risk is minor.
6. Construction impacts	Construction would result in localised amenity impacts related to noise and transport network disruption, but can be managed effectively using well established practices. The potential impacts to the community during the construction of the two projects are typical of any construction project. Comprehensive environmental and traffic management plans would be implemented to ensure legislative and policy requirements are met, and an extensive program of community and stakeholder consultation would be undertaken prior to and during construction to ensure that the community, particularly residents and businesses that may potentially be directly affected, are aware of upcoming works and are able to plan their activities.

Topic	Key finding
7. Noise during operations	Noise modelling confirms that the projects would not exceed the investigation thresholds in the Passenger Rail Infrastructure Noise Policy.
8. Visual amenity	The areas surrounding the projects are highly valued for their coastal setting. The projects would change the visual appearance of the transport corridor through Edithvale and Bonbeach by replacing the existing at-grade rail infrastructure with a modern station building and precinct, car parking on deck, footbridges, safety barriers along the trench and a substation at Edithvale. Although vegetation would be lost, new landscaping would be established. The urban design of the projects would be guided by a comprehensive set of Urban Design Guidelines.

Managing impacts

The Edithvale and Bonbeach level crossing removal projects would be designed, constructed and maintained in accordance with an EMF, included as Chapter 9 of this EES. The EMF provides a transparent and integrated governance framework to manage the potential environmental effects of the Edithvale and Bonbeach level crossing removal projects identified in this EES. It responds to Section 3.5 of the Scoping Requirements issued for the EES, as well as the need to ensure a high level of rigour within the environmental management of both projects.

The objectives of the EMF are to:

- establish a framework to ensure compliance with statutory requirements and minimise environmental risks
- set out the environmental outcomes to be achieved during design and construction and encourage innovation to achieve them
- ensure accountabilities are identified for managing and monitoring environmental effects and hazards associated with the design and construction phases of the projects.

The EMF outlines clear accountabilities for the delivery and monitoring of the implementation of the projects and includes a set of EPRs. The EPRs determine the environmental outcomes that the design and construction of the Edithvale and Bonbeach projects must achieve.

The EMF requires the contractor constructing the projects to implement an Environmental Management System (EMS) certified to AS/NZS ISO 14001:2016 *Environmental management systems – Requirements with guidance* and to comply with relevant legislation, policy and guidelines.

The purpose of the requirement for an EMS is to ensure that works are planned and performed so that the adverse effects on the environment are either avoided, minimised or managed, and are carried out in accordance with the EPRs. The EMF requires the contractor to specifically apply its EMS, and modify it if required for the delivery of works for the projects.

The EMF provides a structured approach for monitoring the implementation of the Construction Environment Management Plan (CEMP) and other plans required to comply with the EPRs, the Incorporated Documents and any statutory approvals.

Finalising the EES process

The EES will be on public exhibition for 30 business days. During this time, the public can read the EES and make written submissions about matters presented within it. Submissions can also be made on the draft planning scheme amendments being exhibited at the same time (see Attachment IV *Draft Planning Scheme Amendment*).

At the end of the public exhibition period, an independent inquiry will consider the effects of the Edithvale and Bonbeach level crossing removal projects, having regard to the EES, the proposed planning scheme amendments and public submissions and provide a report to the Minister for Planning. Following receipt of the inquiry's report, the Minister for Planning will consider the report and issue a written assessment of the projects. This document, called the 'Minister's Assessment', will inform statutory decision-makers responsible for issuing environmental approvals for the projects.

Three main approvals are required:

- Commonwealth approval under the EPBC Act
- Planning Scheme Amendment under the *Planning and Environment Act 1987*
- Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006*.

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GLOSSARY AND ABBREVIATIONS

Abbreviations

Term	Definition
AAQ	Ambient Air Quality
AV	Aboriginal Victoria
ANC	Acid neutralising capacity
AHD	Australian Height Datum
AQM	Air quality management
ARI	Average recurrence interval
ASRIS	Australian Soil Resource Information System
ASS	Acid sulfate soils
bgl	Below ground level
CALD	Culturally and linguistically diverse
CASS	Coastal acid sulfate soils
CCTV	Closed circuit television
CEMP	Construction Environmental Management Plan

Term	Definition
CPTED	Crime prevention through environmental design
CHMP	Cultural Heritage Management Plan
CNVMP	Construction Noise and Vibration Monitoring Plan
CRG	Community Reference Group
CSEMP	Community and Stakeholder Engagement Management Plan
dB	Decibels
DDA	Disability Discrimination Act 1992
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DEPI	Department of Environment and Primary Industry
DELWP	Department of Environment, Land, Water and Planning
EE Act	Environment Effects Act 1978
EES	Environment Effects Statement
EMF	Environmental Management Framework
EMS	Environmental Management System
EP Act	Environment Protection Act 1970
EPA	Environment Protection Authority Victoria
EPR	Environmental Performance Requirement
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
eVDV	Estimated Vibration Dose Value
EVC	Ecological Vegetation Class
GBCA	Green Building Council of Australia
GDE	Groundwater dependent ecosystem
GHG	Greenhouse gas
HERMES	Heritage Management Electronic System
Hha	Habitat hectare
HO	Heritage overlay
IPCC	Intergovernmental Panel on Climate Change
IS	Infrastructure Sustainability

Term	Definition
ISCA	Infrastructure Sustainability Council of Australia
IWRG	Industrial Waste Resource Guidelines
JV	Joint Venture
km	Kilometres
KRA	Key result area
LCZ	Landscape character zone
LGA	Local government area
LSIO	Land Subject to Inundation
LXRA	Level Crossing Removal Authority
LXRP	Level Crossing Removal Program
M11	Mornington Peninsula Freeway
m	Metres
MNES	Matters of National Environmental Significance
MTM	Metro Trains Melbourne
MTPF Act	Major Transport Project Facilitation Act 2009
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
NTU	Nephelometric turbidity unit
PAA	Project Alliance Agreement
PASS	Potential acid sulfate soils
PBC	Polychlorinated Biphenyls
PFAS	Polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PIW	Prescribed industrial waste
PRINP	Passenger Rail Infrastructure Noise Policy
PTV	Public Transport Victoria
PUZ	Public use zone

Term	Definition
Q&A	Question and answer
RACV	Royal Automobile Club of Victoria
SBO	Special Building Overlay
SEPP	State Environment Protection Policy
SLG	Stakeholder Liaison Group
SUP	Shared Use Path
TDS	Total dissolved solids
TI Act	Transport Integration Act 2010
TMP	Traffic Management Plan
TRG	Technical Reference Group
TWA	Trade Waste Agreement
UDG	Urban Design Guidelines
VHI	Victorian Heritage Inventory
VHR	Victorian Heritage Register
WSUD	Water sensitive urban design

Glossary

Term	Definition
Acid neutralising capacity	ANC is the measure of a soil's inherent ability to buffer acidity and resist the lowering of the soil pH. This may be provided by dissolution of calcium and/or magnesium carbonates (e.g. shell), cation exchange reactions, and by reaction with the organic and clay fractions. The efficiency of these buffering constituents and activities is further dependent on the type, amount and particle size of these minerals.
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (e.g. peat) that are formed under water logged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. When oxidised they can generate acidic (aggressive) groundwater.
Action criteria	The measured level of potential plus existing acidity beyond which management action is required if a soil or sediment is to be disturbed. The trigger levels vary for texture categories and the amount of disturbance. The extent of management required will vary with the level of acidity and the volume of the disturbance, among other factors.
Activity area	The area or areas to be used or developed for an activity (such as, Aboriginal cultural heritage).
Actual acid sulfate soils	Acid sulfate soils that have been disturbed and oxygenated and where some or all the sulfides originally present have been oxidised, resulting in a pH of <4.
Actual acidity	Actual acidity represents soluble and exchangeable acidity already present in the soil and is the acidity often formed as a consequence of previous oxidation of sulfides. This acidity will be mobilised and discharged following a rainfall event and measured by titratable actual acidity.
Aeolian	Geology deposited or formed by wind, as loess or dunes.
Alignment	The geometric layout of a road or railway line in plan (horizontal) and elevation (vertical).
Amenity	The overall quality of the built form and natural environment affecting the level of human enjoyment. In this assessment amenity includes noise and vibration, dust, odour, reduced visual amenity and changes to traffic conditions.
Aquifer	A geological formation, group of formations or part of a formation, which contains sufficient saturated permeable material to transmit and yield significant quantities of water.
Aquifer system	A body of permeable or relatively permeable materials that functions regionally as a water yielding unit. It comprises two or more permeable units separated by, at least locally, confining units that impede groundwater movement.
Aquitard	A geological formation, group of formations or bed which is saturated but does not allow water to flow freely to a pumping bore. However, aquitards may transmit appreciable amounts of water between adjacent aquifers.
At-grade	A road at ground level, not on an embankment or in a cutting.
Australian Height Datum (AHD)	The datum used for the determination of elevations in Australia. The determination uses a national network of benchmarks and tide gauges, and sets mean sea level as zero elevation.

Term	Definition
Average Recurrence Interval	The average, or expected, value of the periods between exceedances of a given rainfall total.
A-weighted decibel (dB(A))	A unit used to represent the airborne sound pressure level on a logarithmic scale. A-weighting (A) is a frequency filter applied to measured noise to represent how the human ear hears sound. Noise limits applicable to environmental impacts are typically specified in terms of dB(A).
Bedrock	A general term for rock, usually solid, that underlies soil or other unconsolidated material.
Beneficial use	A use of the environment or any element of the environment which is conducive to public benefit, welfare, safety, health or aesthetic enjoyment and which requires protection from the effects of waste discharges, emissions or deposits.
Biodiversity	The variety of all life-forms, the different plants, animals and micro-organisms, the genes they contain, and the ecosystems of which they form a part.
Bioregion	A landscape-based approach to classifying the land surface using a range of environmental attributes such as climate, geomorphology, lithology and vegetation.
Bioregional Conservation Status	An assessment of the conservation status of the native vegetation type (EVC) in the context of a particular bioregion, taking account of how commonly it originally occurred, the current level of depletion and the level of degradation of condition typical of remaining stands.
Catchment	The land area that drains into a stream, river, lake, estuary, or coastal zone.
Certificate of Environmental Audit	Issued for a property where, following an audit, an environmental auditor believes the environmental condition of the land is suitable for any beneficial use.
Coastal acid sulfate soils	Acid sulfate soils (ASS) can occur in coastal and inland settings. Where ASS occur in coastal settings they are commonly referred to as coastal acid sulfate soils (CASS).
Community cohesion	The quantity and quality of interactions between community members, the extent to which members of a local community know and care about one another and the extent of attachment to a geographic community or a community of interest.
Community infrastructure	A building that accommodates a range of social, educational and recreational activities, meetings, health and support services.
Concept design	Initial functional layout of a rail/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design.
Confined aquifer	A formation in which the groundwater is isolated from the atmosphere at the point of discharge by impermeable geologic formations. Confined groundwater is generally subject to pressure greater than atmosphere.
Connectivity	The ability for people to access community and recreation facilities and their daily needs – easily, safely and without being hindered by barriers.
Contaminant	A substance, element, or compound that, if added to soil or an aquifer, has an adverse effect on the quality of water in that aquifer.
Contaminated land	Land used for industry, mining or the storage of chemicals, gas, wastes or liquefied fuels (if not ancillary to another use of land).

Term	Definition
Contaminated soil	Soil or a mixture of soils that can be classified as Category A, B or C contaminated soil as provided for under the Regulations and defined in the Industrial Waste Guidelines (published in Special Gazette No. S177 on 9 June 2009).
Corrosion	The act or process of dissolving or wearing away a material.
Day	Based on the definition in the PRINP, this is the 16-hour period from 6:00 am to 10:00 pm.
Decibel	A unit of measurement used to express the ratio between two values on a logarithmic scale. As the ear perceives sound energy logarithmically, the decibel is the unit used when referring to noise levels.
Decommissioned bore	A bore – the purpose and use of which have been permanently discontinued.
Dewatering	The lowering of static groundwater levels through extraction, usually by means of pumping from one or several groundwater bores.
Discharge	Any process by which water is removed from an aquifer. Includes water that flows to a surface feature, such as a spring, river or wetland, as well as water which flows to an adjacent aquifer.
Dissolved oxygen	The amount of oxygen dissolved in water, such as groundwater or surface water. Usually measured in parts per million.
Dn	Down – train travel away from Melbourne/Flinders Street Station.
Drawdown	The change in groundwater head level that can generally be attributed to the operation of a pumping bore.
Ecological Vegetation Class (EVC)	EVCs are the standard unit for classifying vegetation types in Victoria. EVCs are described through a combination of floristics, lifeforms and ecological characteristics, and through an inferred fidelity to particular environmental attributes. Each EVC includes a collection of floristic communities (i.e. lower level in the classification) that occur across a biogeographic range, and although differing in species, have similar habitat and ecological processes operating.
Ecology	Ecology is the study of the interrelationships between living organisms and their environments.
Ecosystem	A system that is made up of a community of animals, plants, and bacteria and its interrelated physical and chemical environment.
Environment	Environment is a broad term that includes ecological, cultural, social, heritage, health, safety and economic aspects.
Environmental Performance Requirement	An environmental outcome that must be achieved during design, construction and operation of the projects.
Erosion	The process or group of processes whereby solids in the natural environment are relocated by moving water, glacial ice or wind.
Estimated Vibration Dose Value (eVDV)	A predicted Vibration Dose Value determined from measurement of exposures and vibration levels and applied to a period of time. Used to estimate Vibration Dose Values for residences exposed to multiple events of finite duration (such as passenger train movements).

Term	Definition
Evaporation	The process by which liquid water becomes gaseous, or the volume lost from a body of water due to this process.
Evapotranspiration	Pertains to water lost to the atmosphere via evaporation and transpiration of plants.
Ex situ	A Latin phrase that means 'out of place'. The ex situ investigation refers to soil testing and spoil characterisation once soil is excavated. The ex situ spoil volume refers to volume of excavated soils and includes a bulking factor depending on the soil texture.
Exotic vegetation	Any vegetation that is not native to Australia or its States and Territories. This can sometimes include native species established outside their natural range.
Fault	A fracture or zone of fractures in a geological layer along which there has been displacement of the sides relative to one another.
Groundwater	Water occurring naturally below ground level or water pumped, diverted and released into a bore for storage underground.
Groundwater dependent ecosystems	An ecosystem that requires access to groundwater to meet all or some of its water requirements to maintain the communities of plants and animals and ecological processes is supports, and ecosystem services it provides.
Groundwater monitoring bore	A bore installed with the purpose to; determine the nature and properties of subsurface ground conditions; provide access to groundwater for measuring level, physical and chemical properties; and permit the collection of groundwater samples and conduct of aquifer testing.
Groundwater pumping (production) bore	A bore installed with the primary purpose to extract groundwater from a particular hydrogeological formation by means of a pump.
Habitat hectare	A site-based measure of quality and quantity of native vegetation that is assessed in the context of the relevant native vegetation type. For remnant vegetation: • Habitat hectares of remnant patch = extent in hectares × condition multiplier. For scattered trees: • Habitat hectares of scattered trees = (number of trees × standard extent) × condition multiplier. (Where standard extent is a circle with 15 metre radius).
Habitat zone	A discrete area of native vegetation consisting of a single vegetation type (EVC) with an assumed similar averaged quality. This is the base spatial unit for conducting a habitat hectare assessment.
Hardness	A measure of the mineral content of water, primarily calcium and magnesium ions. 'Hard' water causes an insoluble residue to form when water is used with soap.
Headworks	The part of a bore that protrudes at the ground surface. Usually entails a concrete collar and pad around the bore casing raised above the natural surface to prevent surface water entering the bore.
Heritage item	Any place, building or object listed on a statutory heritage register.

Term	Definition
High-threat weed	Introduced species, including native species occurring outside their natural range (non-indigenous), with the ability to out-compete and substantially reduce one or more indigenous life forms in the longer term, assuming on-going current site characteristics and disturbance regime.
Hydraulic conductivity	The rate at which water at the prevailing kinematic viscosity would move under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow, expressed in metres per day.
Hydrogen sulfide	A gas with the formula H_2S. Commonly known as 'rotten egg gas' due to its smell, H_2S is released from anaerobic systems as a metabolic by-product. The gas is heavier than air and potentially fatally toxic if allowed to accumulate in confined spaces.
Hydrogeochemistry	The chemical characteristics of water in hydrogeological formations.
Hydrogeologic	Those factors that deal with subsurface waters and related geologic aspects of surface waters.
Hydrostratigraphy	The identification and distinction of hydrogeological units based on their hydraulic properties.
Igneous rock	Rocks that solidified from molten material, that is, from magma.
Impact pathway	The consequence of an action or hazardous event that results in a change in conditions.
In situ	A Latin phrase that means 'on-site' or 'in place'. The in situ investigation refers to intrusive investigation of soils in place, prior to being excavated. The in situ spoil volume refers to volume of undisturbed soils prior to disturbance.
Indigenous vegetation	Indigenous vegetation includes vegetation that is native to Australia, as well as being native to a specific geographic region.
Intrusive rock	Igneous rocks formed from magma injected beneath the Earth's surface. Generally, these rocks have large crystals caused by slow cooling.
LAeq	The equivalent continuous sound pressure level measured over a specific period (in dB(A)), and is often referred to as the average sound pressure level over time.
LAeq	Equivalent A-weighted continuous sound pressure level. It is the value of the sound pressure level of a continuous steady sound that has the same acoustic energy as a given time-varying sound pressure level when determined over the same measurement time interval. Often referred to as average sound pressure level.
LAeq,16hr	A-weighted equivalent continuous sound pressure level measured over the 16-hour period from 6:00 am to 10:00 pm.
LAeq,8hr	A-weighted equivalent continuous sound pressure level measured over the 8-hour period from 10:00 pm to 6:00 am.
LAmax	The maximum A-weighted sound pressure level that occurs during a given measurement period.

Term	Definition
Landscape character zones	These are distinct zones of the landscape that are relatively homogenous in character. They are generic in nature in that they may occur in different areas but, wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Leachate	The liquid that has percolated through solid waste and dissolved soluble components.
Lithology	The physical character of a rock or rock formation.
Land subject to inundation overlay	Identification under state planning schemes of land in a flood storage or flood fringe area affected by the 1 in 100-year flood.
Matter of National Environmental Significance	The EPBC Act defines and protects nine MNES: World Heritage properties, National Heritage places, wetlands of international importance (Ramsar sites), listed threatened species and ecological communities, migratory species protected under international agreements (JAMBA, CAMBA, ROKAMBA), Commonwealth marine areas, Great Barrier Reef Marine Park, nuclear actions (including uranium mines), and a water resource, in relation to coal seam gas development and large coal mining development.
Monitoring bore	Refer to 'observation bore'.
Native vegetation	Native vegetation includes all vegetation that is native to Australia, and its States and Territories.
Native vegetation offset	A native vegetation offset is any works or other actions to make reparation for the loss of native vegetation arising from the removal of native vegetation. This may include an area of existing remnant vegetation that is protected and managed, an area that is revegetated and protected, an area that is set aside for regeneration or restoration, or any combination of these. The relative size of an offset is graded according to its conservation significance.
Night	Based on the definition in the PRINP, this is the 8-hour period from 10:00 pm to 6:00 am.
Non-indigenous vegetation or species	Vegetation or species native to Australia, but not to the geographic region within which a site is located.
Nephelometric Turbidity Unit	Unit of measurement for turbidity.
Observation bore	A well drilled in a selected location for observing parameters such as water levels and pressure changes.
Oxidation	Describes the loss of electrons or hydrogen and the gain of oxygen by a molecule, atom or ion, or the increase in oxidation state of an element. The most familiar example of chemical oxidation is rusting iron. In an ASS context, the term is commonly used to refer to the process of pyrite or iron sulfides reacting with oxygen and releasing acid and iron products.
Pedestrian priority route	Priority route for pedestrians in the SmartRoads Road Use Hierarchy.
Permeability	The property or capacity of a porous rock, soil or sediment for transmitting a fluid. It is a measurement of the relative ease of fluid flow within a material.

Term	Definition
pH	A measure of the acidity or alkalinity of a solution. Neutral solutions have a value of 7, this value increases for alkaline solutions and decreases for acidic solutions.
Pile	A pile or piling is a vertical structural element of a deep foundation, driven or drilled deep into the ground.
Pleistocene	Of, relating to, or denoting the first epoch of the Quaternary period, between the Pliocene and Holocene epochs, from 2.5 million years ago to 10,000 years ago.
Polyfluoroalkyl substances	A group of manufactured chemicals called per- and polyfluorinated alkyl substances (PFAS) have historically been used in firefighting foams and other industrial and consumer products for many decades. The two most well-known PFAS are PFOS (perfluorooctane sulfonate) and PFOA (perfluorooctanoic acid).
Porosity	The percentage of the bulk volume of a soil or rock that is occupied by interstices, whether isolated or connected.
Potential acid sulfate soil	These are soils containing iron sulfides that has not been exposed to air and oxidised but will generate acidity if oxidised.
Potential acidity	Potential acidity is the 'hidden' acidity that will be released if all of the sulfide minerals contained within a soil (e.g. pyrite) are fully oxidised.
Preferred traffic route	The highest degree of priority for traffic in the SmartRoads Road Use Hierarchy.
Priority site	Sites for which EPA Victoria has issued a clean-up notice pursuant to Section 62A, or a pollution abatement notice pursuant to Section 31A or 31B (relevant to land and/or groundwater), of the Environment Protection Act 1970.
Project area	Area of land identified around the projects to which the proposed planning scheme amendment applies.
Project footprint	Area of land within the project area that will be directly affected by construction activity necessary to remove the level crossings and build the associated infrastructure.
Rail movement	A rail movement is the passage of a single train consist within the rail corridor.
Ramsar site	A site protected by the Ramsar Convention, an international treaty on the conservation and wise use of wetlands and their resources.
Receptor	A receptor (also called a sensitive receptor) is a location at which noise or vibration is likely to impact upon a noise or vibration sensitive use. Residential premises are an example of sensitive receptor.
Recharge	The process of adding water, or the amount of water added, to the volume of water stored in an aquifer.
Recreation facility	A building, formal or informal open space (including parks) used for passive recreation or sporting activities.
Remediate	To remove, disperse, destroy, dispose of, abate, neutralise or treat any pollutant, waste, substance or environmental hazard in order to restore the environment to a state as close as practicable to the state it was in immediately before contamination.

Term	Definition
Remnant patch	A continuous area of native vegetation, with or without trees, where less than 75 per cent of the total understorey plant cover is weeds or non-native plants (bare ground not included), or a group (i.e. three or more) of trees where the tree canopy cover is at least 20 per cent. Patches may occur across one or more land tenures and may consist of one or more habitat zones.
Risk rating	A risk rating considers the likelihood and consequence of an event.
Salinity	A measure of the dissolved salt content of water or soil.
Special Building Overlay	Identification under state planning schemes of land in urban areas liable to inundation by overland flows from the urban drainage system.
Scattered tree	Scattered trees are those indigenous canopy trees (greater than five metres in height) within an area where at least 75 per cent of the total understorey plant cover is weeds or non-native plants and the overall canopy cover for a group (i.e. three or more) of trees is less than 20 per cent.
Sedimentary rock	Rocks resulting from the consolidation of loose sediments that has accumulated in layers.
Segment	SEPP (Groundwaters of Victoria) categorises groundwater into five segments, each having a particular beneficial use identified. These are maintenance of ecosystems, potable water supply (desirable and/or acceptable), potable mineral water supply, agriculture, parks and gardens and stock watering.
Semi-confined (or leaky) aquifer	An aquifer confined by a layer of moderate permeability (aquitard) that allows vertical leakage of water into or out of the aquifer.
Sensitive use	A land use (as defined within the Planning and Environment Act 1987) that due to the type of use would be sensitive to either noise or vibration impacts. Residences are considered to be sensitive uses, but other uses (such as heritage structures, public recreation areas or places of worship) may also be considered sensitive.
Shared use path	Shared use paths are areas open to the public that are designated for use by both pedestrians and cyclists.
Site type	Category of Aboriginal cultural heritage place held on the Victorian Aboriginal Heritage Register.
SmartRoads	SmartRoads is an approach that manages competing interests for limited road space by giving priority use of the road to different transport modes at particular times of the day.
Sound power level	The sound power level is used to describe the strength of a noise source.
Spoil hazard classification	Under Victorian legislation, producers of contaminated soil must categorise their spoil into one of four categories: Category A, B, C or clean fill. The categorisation determines the management options (for example reuse or disposal) that are available for that material.
Standing water level or static water level	The level of water in a well or bore that is not being affected by pumping of groundwater.

Term	Definition
Statement of Environmental Audit	Issued where, following an audit, an environmental auditor believes the land is not suitable for all possible beneficial uses, but is suitable for specific uses or developments. It may contain conditions for clean-up or management of contamination.
Static water level or standing water level	The level of water in a well that is not being affected by the withdrawal of groundwater.
Stratigraphy	The study of rock layers and layering, especially of their distribution, deposition and age.
Stratigraphy	The study of rock/soil strata, especially of their distribution, deposition and age.
Sub-artesian	Conditions where groundwater rises naturally in a bore to a height appreciably above that of the surrounding water table, but not flowing out of the bore.
Surface water	Any water that collects as a surface features, including rivers, streams, lakes, wetlands and the ocean.
Tanked structure	Waterproof membrane applied over a surface, preventing completely the entry of liquid water under hydrostatic (water) pressure.
Tertiary age	The term for a geologic period from 65 million to 2.6 million years ago, a time span that lies between the superseded Secondary period and the Quaternary period.
Total count	Total count refers to the total number of birds observed over the monitoring period. It is a tally of all observations and does not account for double count of individuals as the same bird may be present at the time of multiple observations.
Total dissolved solids	The total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water.
Traffic route	Traffic route in the SmartRoads Road Use Hierarchy that receives a lower level of priority than a preferred traffic route.
Transmissivity	The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient.
Unconfined aquifer	An aquifer where the water table is exposed to the atmosphere through openings in the overlying materials.
Up	Up – train travel toward Melbourne/Flinders Street Station.
View	A sight or prospect of some landscape, scene, etc.
Vista	A view or prospect, especially one seen through a long, narrow avenue or passage, as between rows of trees, houses, or the like.
Visual receptor	Individual and/or defined groups of people who have the potential to be visually affected by a proposal.
Water quality	The physical, chemical and biological characteristics of water, frequently used by reference to a set of standards against which compliance can be assessed.

Term	Definition
Water table	The level at which the groundwater pressure is equal to atmospheric pressure. It may be conveniently visualised as the 'surface' of the subsurface materials that are saturated with groundwater in a given vicinity. However, saturated conditions may extend above the water table as surface tension holds water in some pores below atmospheric pressure.
Weathering	The mechanical and chemical breakdown of rocks by the action of rain, snow, wind, etc.
Wetland	An area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others.
Water sensitive urban design	Integrates water cycle management into urban planning to achieve water quality and waterway health outcomes.
Yield	The rate at which water can be extracted from a pumping well, typically measured in L/sec or ML/sec.

1 INTRODUCTION

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1.1 Purpose of this document

The purpose of this Environment Effects Statement (EES) is to assess the environmental effects of the proposed Edithvale and Bonbeach level crossing removal projects.

The two projects would lower the Frankston railway line into two trenches, one at Edithvale Road, Edithvale and one at Station Street/Bondi Road, Bonbeach.

The primary focus of the EES is to assess how the trenches could impact on regional groundwater movements and water quality, and what effect this could have on the internationally-important Edithvale-Seaford Wetlands, and other groundwater uses.

The EES also addresses a number of other potential impacts to inform an Environmental Management Framework for the projects.

Fourteen specialist technical studies have been prepared and the findings of these studies are set out in the EES.

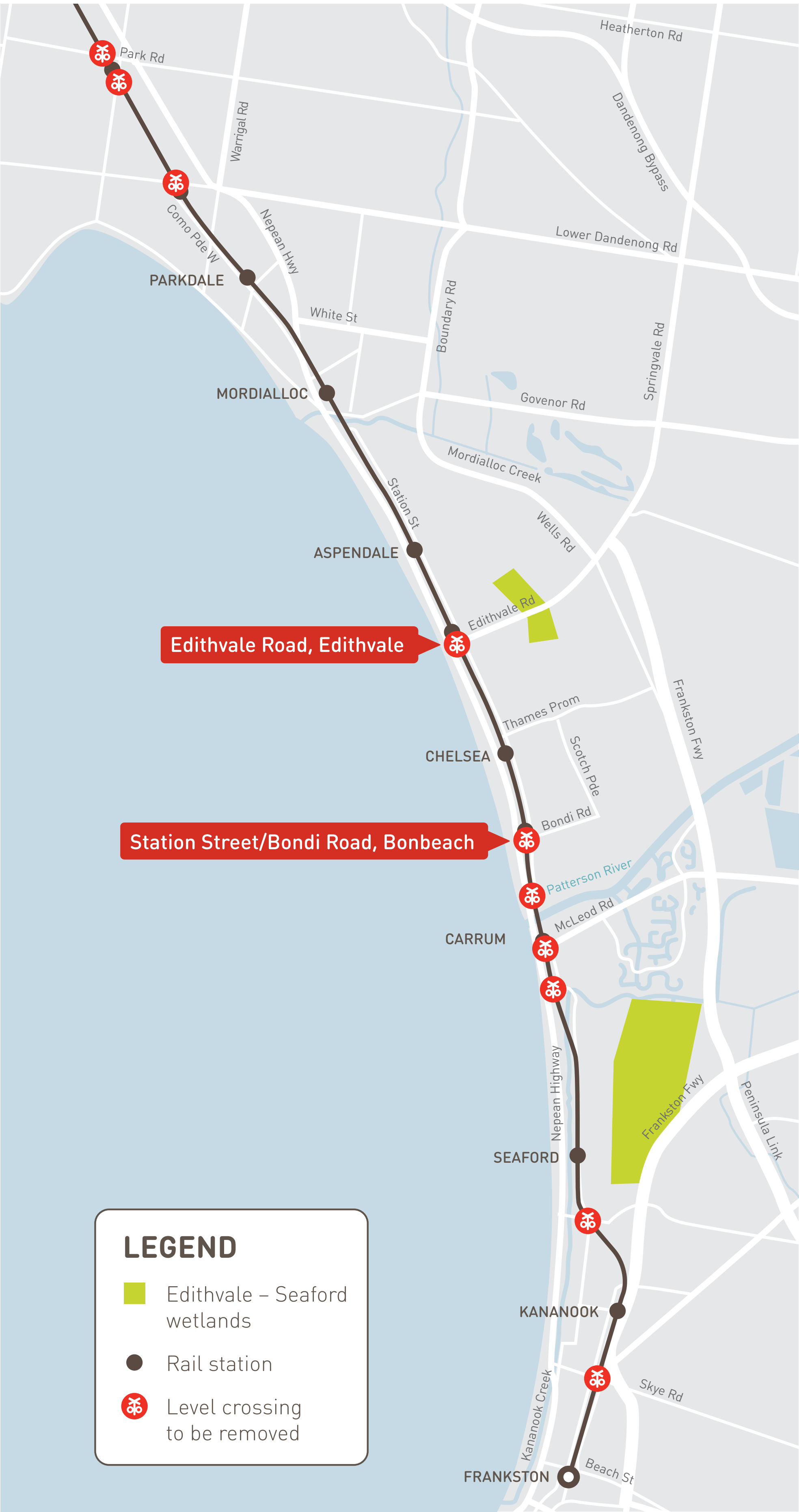
The EES informs the public and stakeholders about the projects, their potential impacts and how those impacts can be avoided, minimised or managed so that any member of the community can make a submission.

The EES and any submissions will be considered by an Inquiry appointed by the Minister for Planning. The Inquiry will provide a report to the Minister.

The Minister for Planning will consider the EES, submissions and the Inquiry report, and issue a written assessment of the projects. This document, called the 'Minister's Assessment', will inform statutory decision-makers responsible for issuing environmental approvals for the projects.

In addition, the Commonwealth Minister for the Environment and Energy has determined that the level crossing removal projects at Edithvale and Bonbeach require approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This is due to the potential cumulative impact on the internationally-important Edithvale-Seaford Wetlands, listed threatened species and migratory species. This EES also considers the Matters of National Environmental Significance for assessment under that Act.

Figure 1.1 Edithvale and Bonbeach level crossings



1.2 Removal of the Edithvale and Bonbeach level crossings

1.2.1 Background to the projects

The Victorian Government is removing 50 of the state's most dangerous and congested level crossings, including the crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach) on the Frankston rail line.

The Frankston rail line serves some of Melbourne's most vital economic centres, as well as vast and growing residential catchments. The corridor currently serves a population of around 250,000 people, which is forecast to grow to around 500,000 people by 2036. It also provides access to the significant industrial precinct and transport gateway at the Port of Hastings, and a key metropolitan activity centre at Frankston. The Frankston Hospital and Monash University campus in Frankston are significant regional employers.

The Level Crossing Removal Authority (LXRA) undertook early planning work, technical investigations and consultation during 2016 to determine the best solution for removing level crossings along the Frankston rail line.

In February 2017, the Victorian Government announced that the level crossings at Edithvale and Bonbeach would be removed by lowering the rail into a trench at each location. New stations would also be built at Edithvale and Bonbeach as part of each project.

On 5 April 2017, the Minister for Planning requested that LXRA prepare an Environment Effects Statement under the *Environment Effects Act 1978* (EE Act) to assess the potential environmental effects of the projects.

1.2.2 Objectives of the projects

The Edithvale and Bonbeach level crossing removal projects are part of the Victorian Government's Level Crossings Removal Program (LXRP). The objectives of the program, which are consistent with the objectives of the *Transport Integration Act 2010* (TI Act), are to:

- deliver significant safety improvements for drivers, cyclists and pedestrians
- improve travel around the local areas – for train users, pedestrians, cyclists and drivers
- get people home safer and faster
- make our roads more reliable, enabling people to better predict their travel times
- stimulate economic growth by creating jobs during construction
- revitalise local communities, including modernisation of station precincts
- enable more trains to run more often and on time.

Each level crossing removal project contributes to the objectives of the overall LXRP.

The program also includes the Metropolitan Network Modernisation Program improvements (including new train stations, improved public transport access, and new pedestrian and cycling links) and amenity improvements such as landscaping and streetscape improvements.

Within this broader context, the specific objectives of the Edithvale and Bonbeach level crossing removal projects are to:

- improve transport safety in the Edithvale and Bonbeach areas
- reduce traffic congestion in the Edithvale and Bonbeach areas
- generate local jobs and stimulate the local economy
- facilitate additional train services on the Frankston rail line.

The projects also include significant upgrades to the existing Edithvale and Bonbeach stations, which are reaching the end of their intended design life, as well as improvements to public areas around the stations.

The benefits of the removal of the Edithvale and Bonbeach level crossings align with the projects' objectives through:

- eliminating the risk of collision between trains and vehicles, cyclists and pedestrians
- improving amenity at Edithvale and Bonbeach stations, contributing to improved transport safety
- eliminating the traffic delays associated with the level crossings for the 14,000 vehicles that use the Edithvale level crossing and the 4,500 vehicles that use the Bonbeach level crossing each weekday
- generating hundreds of jobs within the local areas for the duration of the construction program
- facilitating more train services on the Frankston line.

Refer to Chapter 2 *Rationale and project descriptions* for further discussion of project benefits.

1.2.3 Applying the Transport Integration Act

The TI Act is Victoria's principal transport statute. It requires that all decisions affecting the transport system be made within the same integrated decision-making framework and support the same objectives.

The TI Act provides a framework with six transport system objectives and eight decision-making principles (how we deliver this aim). The Victorian Government has developed a framework to help people understand three related objectives of the TI Act – economic prosperity, social and economic inclusion and environmental stability (State of Victoria, 2012[1]).

At the strategic level, the business case for the LXRP was developed and endorsed within this policy framework, implementing the requirements of the TI Act. The LXRP includes the removal of the Edithvale and Bonbeach level crossings.

The objectives and decision-making principles of the TI Act have, in addition, been further applied to the detailed development of the Edithvale and Bonbeach level crossing projects.

The Minister for Planning must consider the objectives and decision-making principles of the TI Act and determine the weight to be given to each of them when assessing this EES and deciding whether to approve the planning scheme amendments for the projects. LXRA is also required to have regard to these objectives and principles and determine the weight to be given to them when exercising its powers and performing its functions under the relevant legislation.

1.2.4 Developing the projects

The development of each project has progressed from preliminary options assessment to selection of a preferred 'rail under road' (trench) option to a design.

Across each of the development phases, the design was refined through an iterative process involving technical and environmental assessments, and community and stakeholder consultation. This process has ensured the objectives of the projects are met, that the relevant legislative and policy requirements are addressed, and the potential risks and adverse environmental impacts are minimised.

Refer to Chapter 2 *Rationale and project descriptions* for design details, including proposed construction methodologies for each project. Refer to Chapter 12 *Community and stakeholder engagement* for a description of the consultation conducted.

An overview of each project design is provided in Sections 1.3 (Edithvale) and 1.4 (Bonbeach).

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[1] *State of Victoria (2012). Transport and the triple bottom line – Transport's role in driving the economic, social and environmental objectives of the Transport Integration Act 2010.*

1.3 Edithvale level crossing removal project

1.3.1 Location

The level crossing at Edithvale Road is located south of the existing Edithvale train station between Nepean Highway and Station Street. It is approximately 32 kilometres from Flinders Street Station. Edithvale Road runs in an east-west direction between the Nepean Highway and Wells Road, and is a declared arterial road linking Edithvale and surrounding suburbs to the Nepean Highway, the Mornington Peninsula Freeway (M11) and to Melbourne's eastern suburbs via Springvale Road, Eastlink and Westall Road.

The Edithvale project area is located predominantly within the existing rail reserve owned by VicTrack. The rail reserve was established in the early 1880s and has been disturbed by more than a century of rail-related activities.

The Edithvale project area extends from Lincoln Parade, Aspendale to Chelsea Road, Chelsea. It includes the rail corridor and all of Station Street and Nepean Highway to the east and west, and small sections of adjacent road reserves.

Existing pedestrian and cyclist crossings in proximity to the level crossing are located at Lochiel Avenue, Edithvale Road, Denman Avenue, Fraser Avenue and Berry Avenue.

No private land will be required for the project.

An overview of the Edithvale project area is shown in Figure 1.2.

1.3.2 Project description

The Edithvale project involves removing the level crossing by lowering the Frankston rail line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level.

The trench would be constructed between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length, 14 metres wide at the narrowest point, widening up to 24 metres at the new Edithvale Station. The rail track would be approximately eight metres below ground level at its lowest point at Edithvale Station and therefore the maximum depth of excavation would be 14 metres to allow for underground infrastructure (below the rail track) to collect and divert rain water from the trench. Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would be required to provide for the new station building, car parking and a substation required to ensure sufficient power is available for passenger services on the Frankston rail line. New pedestrian bridges would be constructed to retain pedestrian access across the rail line. A new station at the same location as the existing station would be constructed with disability discrimination compliant access to the below-ground train platforms.

1.4 Bonbeach level crossing removal project

1.4.1 Location

The level crossing at Station Street/Bondi Road is located south of the Bonbeach train station between Nepean Highway and Station Street. It is approximately 35 kilometres from Flinders Street Station.

The Bonbeach project area is located predominantly within the existing rail reserve owned by VicTrack. The rail reserve was established in the early 1880s and has been disturbed by more than a century of rail-related activities.

The Bonbeach project area extends from Chelsea Road, Chelsea to Patterson River, Bonbeach. It includes the rail corridor and all of Station Street and Nepean Highway located to the east and west, and small sections of adjacent road reserves.

Existing pedestrian and cyclist crossings across the rail corridor are located at Golden Avenue, Wellwood Road, Bondi Road and The Glade.

No private land will be required for the project.

An overview of the Bonbeach area is shown in Figure 1.3.

Figure 1.2 Edithvale project area

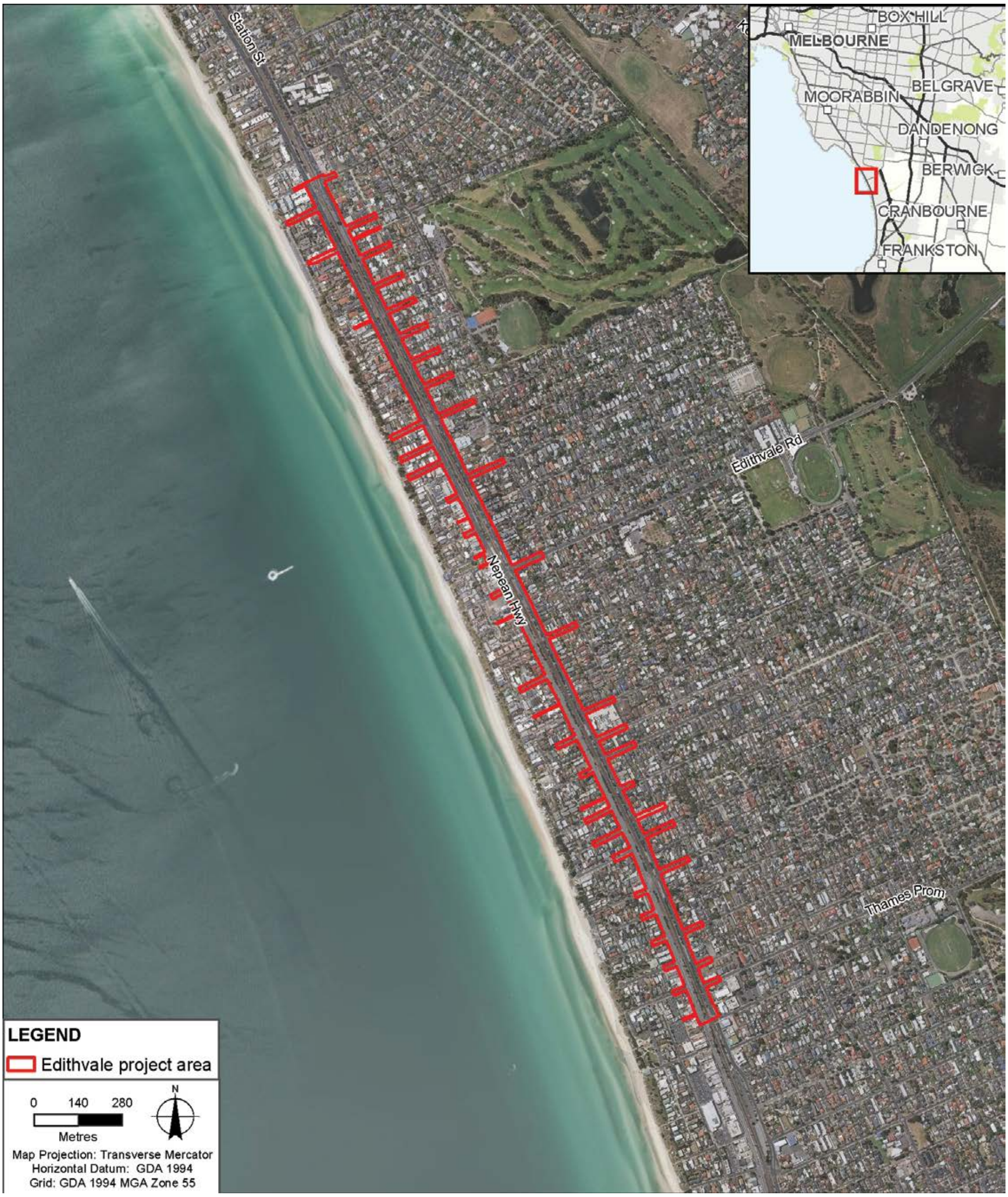
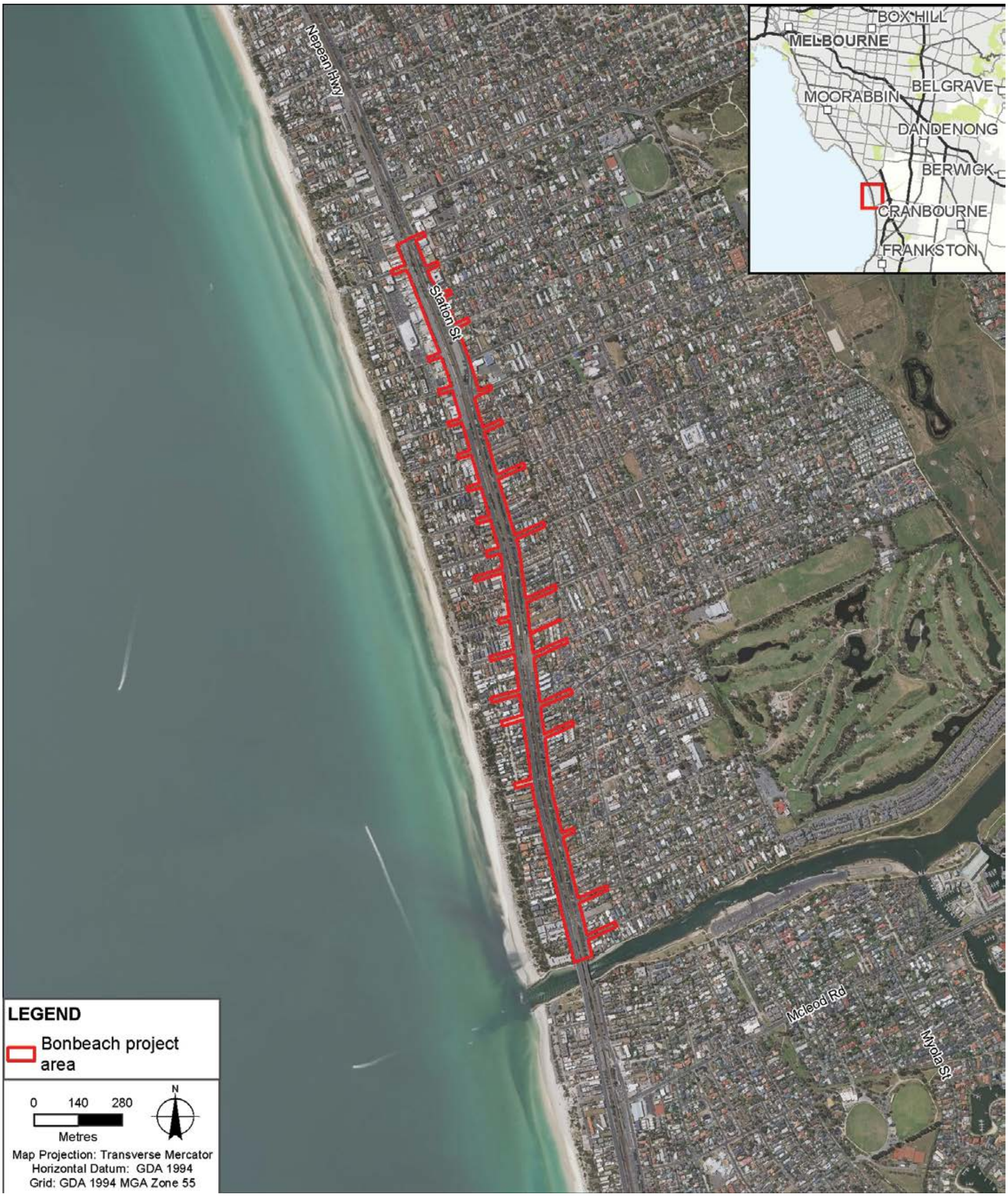


Figure 1.3 Bonbeach project area



1.4.2 Project description

The Bonbeach project involves removing the level crossing by lowering the Frankston rail line into a trench under Bondi Road while maintaining Bondi Road at the current road level.

The trench would be constructed between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening up to 24 metres at the new Bonbeach Station platforms. The rail track would be approximately eight metres below ground level at its lowest point at Bonbeach Station and therefore the maximum depth of excavation would be 14 metres to allow for underground infrastructure (below the rail track) to collect and divert rain water from the trench. Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would provide for the new station building and car parking. New pedestrian bridges would be constructed to retain pedestrian access across the rail line. A new station at the same location as the existing station would be constructed with disability discrimination compliant access to the below-ground train platforms.

1.5 Delivering the projects

1.5.1 Proponent

LXRA is an administrative office of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and is one of several Victorian Government agencies delivering its integrated transport policy objectives.

LXRA is responsible for the delivery of the 50 level crossing removals, including the level crossings at Edithvale and Bonbeach, for the Victorian Government.

LXRA is responsible for:

- developing the design of the level crossing removal projects
- coordinating technical investigations
- preparing this EES
- engaging and informing stakeholders and the wider community
- obtaining the key planning and environmental approvals
- coordinating procurement activities to appoint a private sector construction partner
- coordinating the commissioning of the new infrastructure
- delivering the projects as a member of the construction Alliance (refer to Section 1.5.2).

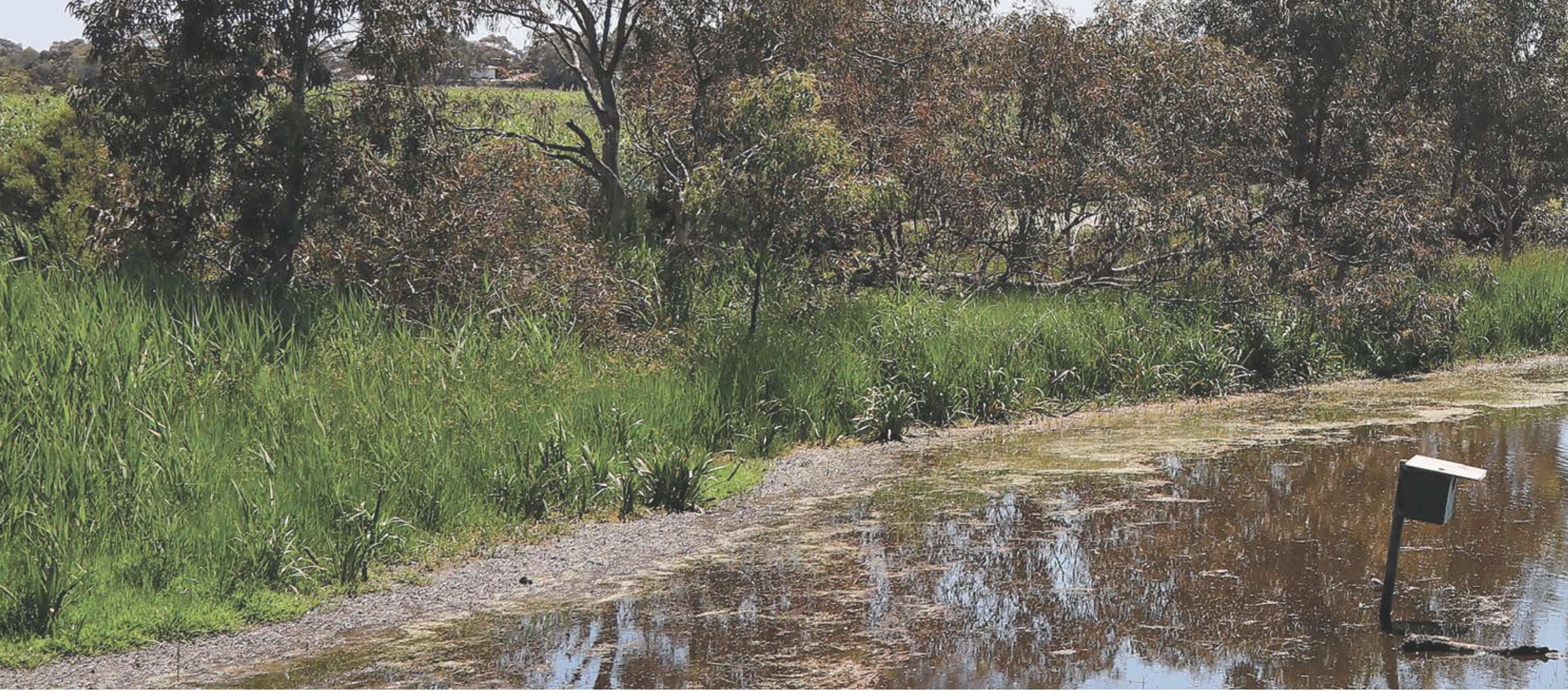
LXRA and DEDJTR have a sound environmental management record, and promotes sustainable development within its projects. Neither organisation has been subject to any proceedings under a Commonwealth or State law for the protection of the environment or the conservation and sustainable use of natural resources. A copy of LXRAs environment and sustainability policies are provided in Attachment IV *LXRA corporate policies*.

Once the construction is complete, LXRA would return the finished rail infrastructure to VicTrack, the Victorian Government body which owns Victoria's transport land, assets and infrastructure. Rail operations will be conducted by Metro Trains Melbourne (MTM) in accordance with network demand.

1.5.2 Project procurement

The projects would be delivered through an Alliance model in which the preferred construction partner works alongside LXRA and MTM to prepare detailed designs and construct the project. A private sector construction partner would be appointed following receipt of all neccessary environmental and planning approvals, with construction planned to commence in 2019. The level crossing would be removed by 2022.

LXRA staff would work within the Alliance team and LXRA would also provide corporate oversight of the Alliance's performance.



1.5.3 Major Transport Projects Facilitation Act 2009

The projects were declared by the Premier to be major transport projects under the *Major Transport Projects Facilitation Act 2009* (MTPF Act) on 21 September 2017. Under the Premier's declaration, the provisions of the MTPF Act apply to the projects with the exception of Part 3 (Assessment and approval of major transport projects) and Part 8 (Assessment Committees).

The effect of the declaration is that once project approvals are obtained, LXRA can facilitate delivery of the projects by using the delivery provisions of the MTPF Act. This will streamline public land access and temporary road closures and utility relocation.

The Minister for Public Transport has been appointed as the Project Minister and the Secretary of DEDJTR as the project proponent for both projects.

1.5.4 Timelines

The timeframes for procurement, design, construction and operation of the Edithvale and Bonbeach level crossing removal projects are shown in Figure 1.4 below.

Figure 1.4 Project timeline

Late 2016 – early 2017
- ongoing community consultation
- preliminary assessment and design

2017
- prepare EES
- design to inform EES assessment

2018
- EES exhibition and Inquiry
- Minister for Planning's assessment
- obtain statutory approvals
- contract award[2]

2019
- detailed design
- commence construction

The Edithvale and Bonbeach level crossing removal projects would require an occupation and shutdown of the rail corridor of six weeks, with two- to four-month closures of each train station. All construction activity, including preparatory works, landscaping and traffic management, would occur over an 18-month period.

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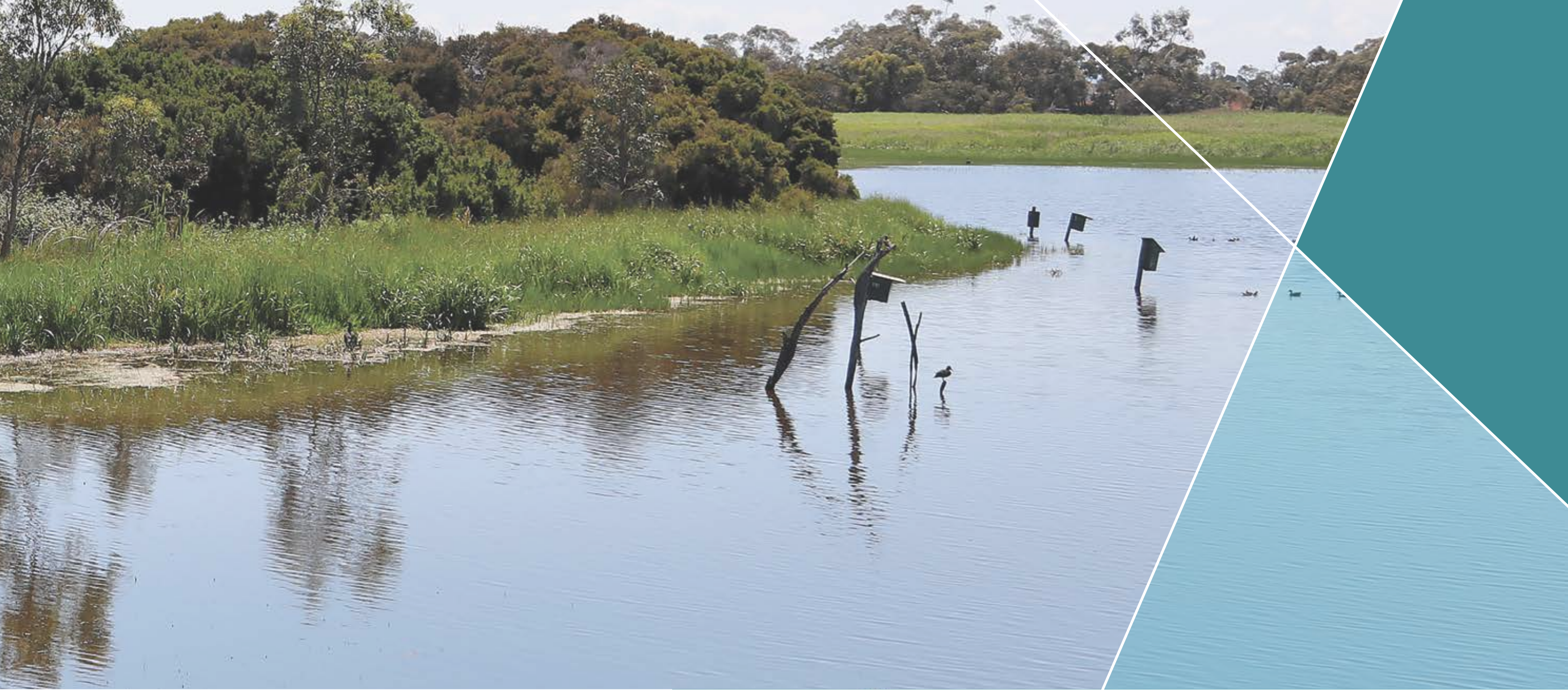
[2] *Following receipt of all statutory approvals*



1.6 Environment Effects Statement

1.6.1 Requirement for an EES

Victoria's EE Act sets out the process under which the Minister for Planning may require the proponent of a project to prepare an EES.

LXRA submitted a referral under the EE Act to the Minister for Planning describing the potentially significant effects of the projects following a preliminary assessment of the proposed projects.

On 5 April 2017, the Minister for Planning determined that an EES was required to inform the Minister's assessment of the projects and the approvals required for the projects.

The Minister's reasons for making this decision included that the project works have 'the potential for a range of significant environmental effects'. In particular the project could potentially have significant effects on:

- The regional groundwater regime resulting in potential changes to hydrological conditions at the Ramsar listed Edithvale-Seaford Wetlands.
- The ecological character and habitat values of the Edithvale-Seaford Wetlands, and the dependent flora and fauna, in particular the critical components of habitat for listed waterbirds, due to alterations in the groundwater regime.
- The protected beneficial uses of groundwater, due to alterations in the groundwater regime, along with risks to human health, recreation and ecosystems due to changes in water quality from activation and excavation of potentially acid sulfate soils and from interception/movement of existing contaminated soil and groundwater.

The Minister's decision determined that 'other potential effects on the social or environmental setting are unlikely to be significant and should be readily addressed and mitigated through existing statutory processes' including under the *Environment Protection Act 1970* and *Planning and Environment Act 1987*.

1.6.2 Role of the EES

The EES will inform the Minister for Planning's assessment of the project and other decision-makers.

An EES is not an approval process in itself. An EES is an assessment that demonstrates the ability of the projects to meet statutory requirements. It provides decision-makers (including ministers and other statutory authorities) with the information they need to make decisions about whether statutory approvals for the project should be granted and, if so, what conditions should apply. The necessary statutory approvals required for the Edithvale and Bonbeach level crossing removal projects are outlined in Attachment I *Legislation and Policy Report*.

This EES:

- describes the proposed Edithvale and Bonbeach level crossing removal projects
- describes the existing environment that may be affected by the projects
- identifies the potential effects of the projects on the environment
- recommends ways to avoid, minimise, offset or manage any adverse effects
- proposes an environmental management framework for managing and monitoring environmental effects during implementation of the projects.

1.6.3 EES process

The EES process is designed to be rigorous and transparent, with opportunities provided for input from stakeholders and the wider community. Figure 1.5 provides an overview of the main steps in the EES process for the level crossing removal projects, aligned with the project-wide statutory approvals that will need to be obtained before the projects can proceed. As Figure 1.5 shows, supporting documents relating to these project-wide approvals are prepared alongside the EES. These approvals are discussed in Section 1.7.

The Victorian Government's EES process is accredited to assess impacts on Matters of National Environmental Significance under the EPBC Act through the Bilateral (Assessment) Agreement between the Commonwealth and the State of Victoria. This EES therefore also considers Matters of National Environmental Significance.

The administrative procedures for the steps outlined in Figure 1.5 are set out in the Ministerial guidelines for assessment of environmental effects under the EE Act, available on the Department of Environment, Land, Water and Planning (DELWP) website <www.delwp.vic.gov.au>.

Statutory decision-makers consider the Minister for Planning's assessment of the environmental effects of the projects after the approaches to avoiding, minimising or managing impacts set out in this EES are taken into account.

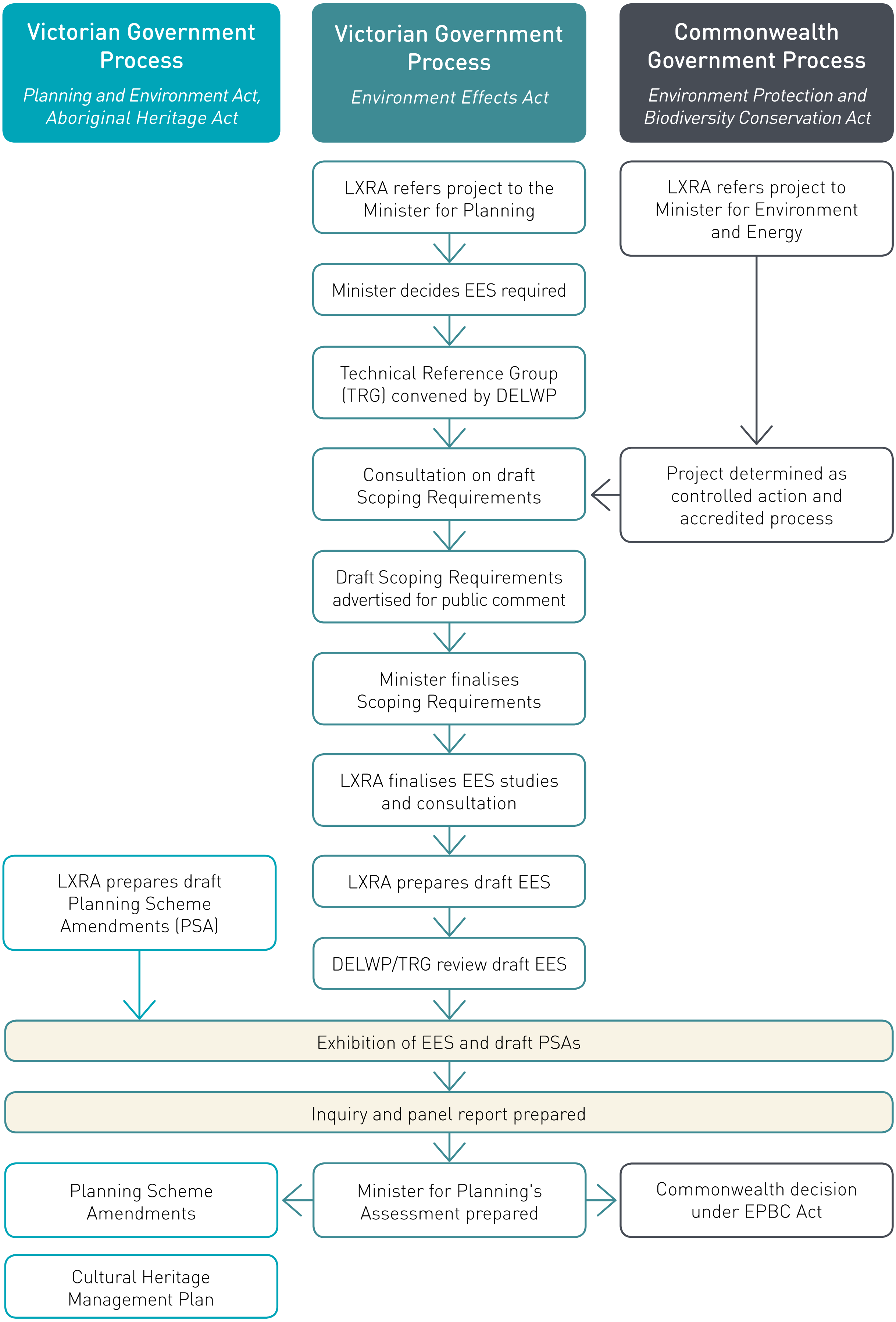
The Commonwealth Minister or delegate will receive the Minister for Planning's assessment under the EE Act at the conclusion of the EES process and use it as the basis for deciding on the approval of the projects under the EPBC Act.

1.6.4 Consultation

A Consultation Plan was developed to inform the public and consult with individuals and stakeholders potentially affected by the projects. The plan outlined opportunities for input into the EES process, including raising specific issues of concern, identifying potential impacts, proposing possible mitigation measures and providing additional information to inform the project's technical specialist investigations and design.

A program for community consultation, stakeholder engagement and communications is proposed for the implementation of the projects. This would include opportunities for local stakeholders to engage with LXRA to seek responses to issues that might arise during the implementation of the projects. The program is described in Chapter 12 *Community and stakeholder engagement*.

Figure 1.5 Key steps in the EES process


Victorian Government Process
Planning and Environment Act, Aboriginal Heritage Act
Victorian Government Process
Environment Effects Act
Commonwealth Government Process
Environment Protection and Biodiversity Conservation Act
LXRA refers project to the Minister for Planning
LXRA refers project to Minister for Environment and Energy
Minister decides EES required
Technical Reference Group (TRG) convened by DELWP
Consultation on draft Scoping Requirements
Project determined as controlled action and accredited process
Draft Scoping Requirements advertised for public comment
Minister finalises Scoping Requirements
LXRA finalises EES studies and consultation
LXRA prepares draft Planning Scheme Amendments (PSA)
LXRA prepares draft EES
DELWP/TRG review draft EES
Exhibition of EES and draft PSAs
Inquiry and panel report prepared
Planning Scheme Amendments
Minister for Planning's Assessment prepared
Commonwealth decision under EPBC Act
Cultural Heritage Management Plan

1.6.5 Scoping requirements and evaluation objectives

The matters to be investigated and documented in the Edithvale and Bonbeach Level Crossing Removal Projects EES are set out in the 'Scoping Requirements' issued by the Minister. The purpose of the Scoping Requirements are to ensure that the EES:

- properly responds to the decision made by the Minister for Planning that an EES is required
- identifies potential significant environmental effects of the Edithvale and Bonbeach level crossing removal project works
- explains how the environmental effects of the works are proposed to be managed for the different stages and aspects of the Edithvale and Bonbeach level crossing removal projects
- provides sufficient and appropriate information to allow the Minister to assess the environmental effects of the works under the EE Act.

Draft Scoping Requirements were exhibited by the Department of Environment, Land, Water and Planning (DELWP) for public comment. After considering public submissions, the Minister published final Scoping Requirements in September 2017. This EES has been prepared in accordance with the final Scoping Requirements.

The Scoping Requirements established draft evaluation objectives for the EES (listed in Table 1.1). These objectives reflect the decision of the Minister for Planning on the need for an EES. The objectives also identify identify key issues related to how the trenches could impact on regional groundwater movements and what effect this could have on the Edithvale-Seaford Wetlands, and how the trenches could expose pre-existing contamination and potential acid sulfate soils which could possibly affect human health, recreation and ecosystems.

The EES may also address other significant issues not identified in the Scoping Requirements that emerge during the EES investigations and consultation process to inform the development of the Environmental Management Framework.

Table 1.1 Draft evaluation objectives

Draft evaluation objectives	Key legislation
Groundwater To minimise effects on the regional groundwater regime and quality particularly as they might impact on the hydrology of the Edithvale-Seaford Wetlands and elsewhere on other beneficial users	*Environment Protection and Biodiversity Conservation Act 1999* *National Environment Protection Council Act 1994* *Environment Protection Act 1970* *Water Act 1989* *National Water Quality Management Strategy 1994*
Biodiversity To avoid, minimise and/or offset adverse effects on native vegetation, listed threatened species and ecological communities, listed migratory species, the Ramsar listed Edithvale-Seaford Wetlands, other protected flora and fauna and groundwater dependent ecosystems	*Environment and Biodiversity Protection Act 1999* *Planning and Environment Act 1987* *Flora and Fauna Guarantee Act 1988* *Wildlife Act 1975* *Fisheries Act 1995* *Catchment and Land Protection Act 1994*
Contaminated/acid sulfate soils To prevent adverse environmental or health effects from disturbing, storing or influencing the transport/movement of contaminated or acid-forming material	*Environment Protection Act 1970* *Planning and Environment Act 1987* *Catchment and Land Protection Act 1994*

1.7 Project approvals

The Edithvale and Bonbeach level crossing removal projects must obtain a number of statutory approvals.

Three main approvals are required:

- Commonwealth approval under the EPBC Act
- Planning Scheme Amendment under the *Planning and Environment Act 1987*
- Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006*.

Other approvals are required for specific aspects of the works, for example removal of vegetation protected under the *Flora and Fauna Guarantee Act 1988*. Details of all the applicable legislation are provided in Attachment I *Legislation and Policy Report*.

1.7.1 Commonwealth approvals

The Commonwealth EPBC Act provides the legal framework to protect and manage designated Matters of National Environmental Significance. Under the EPBC Act, if the Commonwealth Minister for the Environment decides that a project has, will have, or is likely to have a significant impact on a matter of national environmental significance, the project becomes a 'controlled action' that must be assessed and approved by the Minister before it can proceed.

LXRA referred the Edithvale and Bonbeach level crossing removal projects to the Commonwealth Government under the EPBC Act. On 8 May 2017, the delegate for the Commonwealth Minister for the Environment and Energy determined that the projects are a 'controlled action' and that further assessment and approval is required under the EPBC Act before the two projects can proceed. The decision was made due to the potential for significant impacts on the ecological character of the internationally-important Ramsar listed Edithvale-Seaford Wetlands, and the associated listed threatened and migratory flora and fauna, by the projects.

1.7.2 Victorian approvals

The projects require approvals under Victorian legislation, including:

- an amendment to the Kingston Planning Scheme under the *Planning and Environment Act 1987* for each project
- a CHMP under the *Aboriginal Heritage Act 2006*.

Ordinarily, at the conclusion of an EES process, the Minister for Planning may decide to amend the planning scheme under Section 20(4) of the *Planning and Environment Act 1987* to facilitate the projects. The proposed amendments would put in place a special type of planning control called an 'Incorporated Document'. The document would set out the conditions that LXRA must meet during the delivery of the projects. Draft Incorporated Documents for each project are included in Attachment V *Draft Planning Scheme Amendments*.

Other project approvals required for the projects under Victorian legislation may include:

- a permit to take protected flora under the *Flora and Fauna Guarantee Act 1995*
- a consent for works within a road reserve under the *Road Management Act 2004*
- a licence to use groundwater and/or a permit for works on waterways under the *Water Act 1989*
- a management authorisation to remove any wildlife under the *Wildlife Act 1975*
- consent under the *Coastal Management Act 1995*.

1.8 Environmental compliance

In addition to approvals, there are a number of relevant legislation, policies, guidelines and standards that the projects must comply with – such as contingency measures to address unanticipated situations like discovering heritage items.

Some of these have specific requirements for the impact assessment and some have implications for the construction and/or design of the projects. Relevant legislation and its implications for the projects are summarised in Attachment I *Legislation and Policy Report* and in each relevant technical report attached to this EES.

1.9 Approach to the EES

This EES presents each level crossing removal as a separate project.

The projects are described separately because, despite being in close proximity to each other, each level crossing removal is independent of the other in terms of design approach, construction approach and operation. While there is a cumulative benefit of both projects being delivered, each project could be delivered independently and continue to achieve the objectives set out in Section 1.2.2.

While the projects are described separately, the potential cumulative impacts are considered where appropriate. For example, changes to groundwater levels need to be considered in the context of both projects being built. There would also be cumulative impacts from construction activities occurring at the same time for each project. It is recognised in the EES that LXRA proposes to deliver the projects concurrently.

The EES focuses on the potential effects of the permanent infrastructure and construction phase activities. When complete, the infrastructure will be operated in accordance with network demand. The EES assesses how the design of the infrastructure could affect the environmental performance of the train operations.

Construction of the projects would require additional land for temporary laydown areas and offices. The location of these facilities would be remote from the rail corridor. Where planning and other permits may be required they would be obtained separately within the context of the relevant legislation.

1.9.1 Environmental impact assessment

The EES Scoping Requirements provide three draft evaluation objectives focusing on outcomes for groundwater, biodiversity and contaminated/acid sulfate soils.

This EES has focused its investigations to respond to the three draft evaluation objectives, with critical studies subject to peer review. In addition, to ensure that all issues are addressed, LXRA has conducted a suite of further investigations, in order to assess the projects and develop the required Environmental Performance Requirements (refer to Section 1.9.2).

In total, 14 specialist technical assessments have evaluated the potential environmental effects (both adverse impacts and benefits) of the Edithvale and Bonbeach designs, including construction methodologies and operational requirements.

The specialist studies also assessed how the adverse environmental effects of the projects can be mitigated as well as matters that should be considered for inclusion in the Environmental Performance Requirements.

The specialists have applied a systems and risk-based approach to identifying and assessing potential environmental effects across interrelated specialist studies, and also considered potential cumulative effects. The risk-based approach is described in Chapter 4 *Assessment Framework*.

The specialist technical reports are attached to the EES.

1.9.2 Environmental Performance Requirements

One of the key outcomes of the EES process is to recommend a set of Environmental Performance Requirements (EPRs). The EPRs define the environmental outcomes that must be achieved during design, construction and operation of the Edithvale and Bonbeach level crossing removal projects regardless of the detailed design solutions adopted. Under the performance-based approach being adopted for the projects, it would be up to the Alliance to determine how best to achieve the EPRs. The implementation of the Environmental Management Framework (see Section 1.9.3) would provide oversight of the Alliance's achievement of the EPRs.

The 14 technical specialists developed an initial set of EPRs as part of their impact assessments. These assessments evaluated the environmental effects of the projects and the proposed construction methodologies. Through the risk assessment process, the initial set of EPRs was refined to a final set of EPRs that reflect the findings of the impact assessment and the designs.

The approach adopted to develop and refine the EPRs and assess environmental risks and impacts is described in Chapter 4 *Assessment Framework*. A full list of the EPRs for the project is set out in Chapter 9 *Environmental Management Framework*.

1.9.3 Environmental Management Framework

LXRA would prepare and implement an Environmental Management Framework (EMF) for the projects. The proposed EMF and EPRs are included in this EES in Chapter 9 *Environmental Management Framework*.

The EMF is the overarching framework for addressing all environmental requirements for the projects and includes the EPRs.

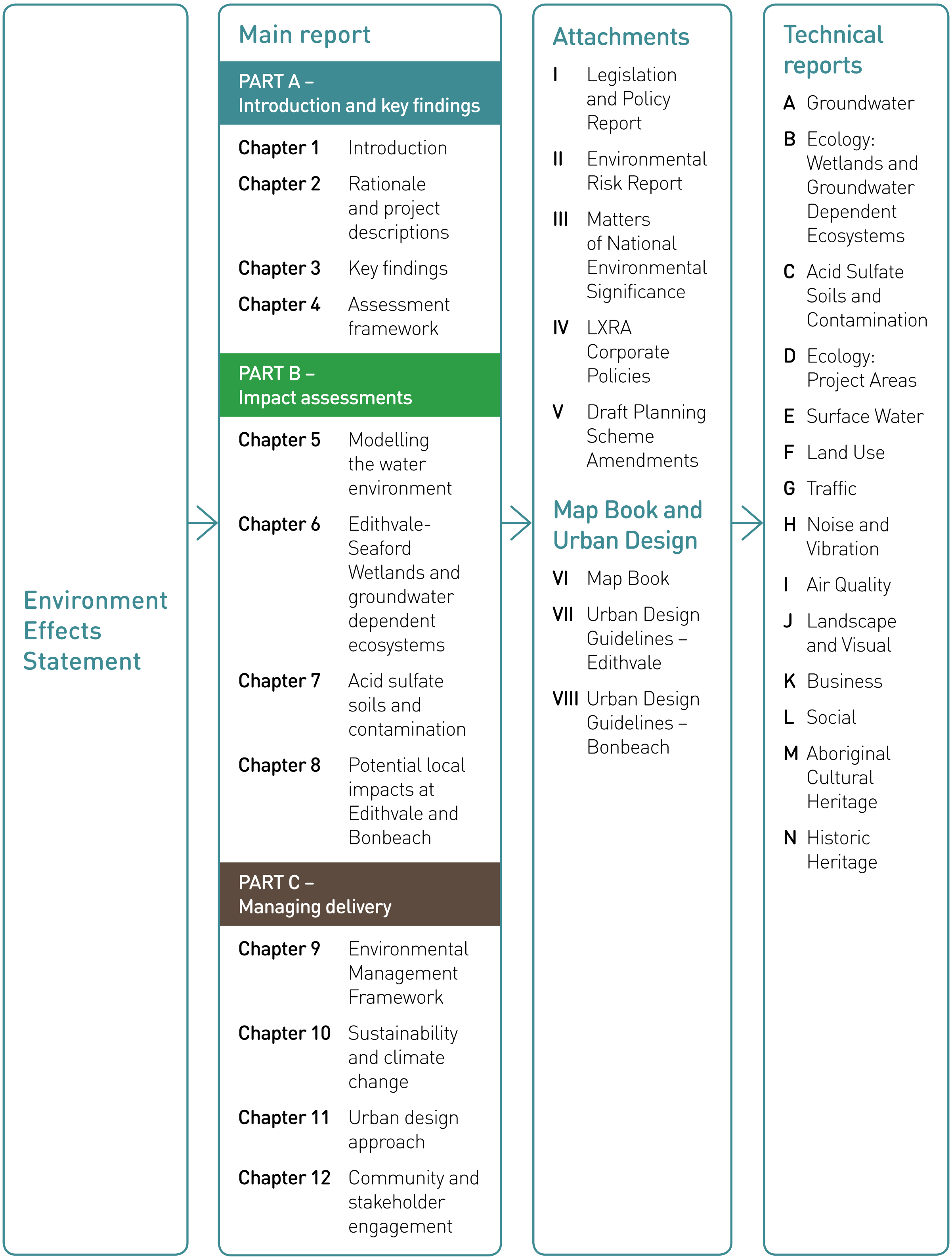
Under the proposed planning scheme amendment conditions, the EMF would be approved by the Minister for Planning subject to any changes the Minister may require to ensure a robust regime for managing the environmental impacts of the projects.

A key component of the EMF is a Construction Environmental Management Plan (CEMP) that would be prepared for the projects that meets the requirements of the EMF and any relevant conditions of project approvals.

1.10 EES structure

The structure of this EES is shown in Figure 1.6.

Figure 1.6 Structure of this EES



Environment Effects Statement

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Main report

PART A – Introduction and key findings

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Chapter 2	Rationale and project descriptions
Chapter 3	Key findings
Chapter 4	Assessment framework

PART B – Impact assessments

Chapter 5	Modelling the water environment
Chapter 6	Edithvale-Seaford Wetlands and groundwater dependent ecosystems
Chapter 7	Acid sulfate soils and contamination
Chapter 8	Potential local impacts at Edithvale and Bonbeach

PART C – Managing delivery

Chapter 9	Environmental Management Framework
Chapter 10	Sustainability and climate change
Chapter 11	Urban design approach
Chapter 12	Community and stakeholder engagement

→

Attachments

I	Legislation and Policy Report
II	Environmental Risk Report
III	Matters of National Environmental Significance
IV	LXRA Corporate Policies
V	Draft Planning Scheme Amendments

Map Book and Urban Design

VI	Map Book
VII	Urban Design Guidelines – Edithvale
VIII	Urban Design Guidelines – Bonbeach

→

Technical reports

A	Groundwater
B	Ecology: Wetlands and Groundwater Dependent Ecosystems
C	Acid Sulfate Soils and Contamination
D	Ecology: Project Areas
E	Surface Water
F	Land Use
G	Traffic
H	Noise and Vibration
I	Air Quality
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K	Business
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2.1 Introduction

This chapter describes the rationale, development, design, construction and operation of the proposed Edithvale and Bonbeach level crossing removal projects (the projects).

The description of the projects has been developed to provide an understanding of all components, processes and development stages, and to enable assessment of their likely potential environmental effects.

The project description includes specific commitments to minimise those aspects of the projects that have the potential to generate negative impacts.

2.2 Project rationale

The endorsed Victorian Government Business Case for the Level Crossing Removal Project (LXRP) sets out the wide-ranging benefits of removing 50 level crossings across Melbourne (Victorian Government, 2017[1]). The Edithvale and Bonbeach level crossings are two of the nominated 50 level crossings to be removed in the LXRP. The program also includes the Metropolitan Network Modernisation Program which comprises new train stations, improved public transport access, and improved pedestrian and cycling links.

Prior to the commencement of the LXRP, level crossings have been removed one at a time or in pairs, and over many years. While this approach goes some way toward addressing localised issues, the scale of the problem is so big that it calls for a strategic approach and corresponding scale of investment.

Melbourne is Australia's fastest growing city, heading towards a population of six million by 2031 and more than 7.8 million by 2051. As the city grows, reliable and highly efficient transport networks are essential to moving more and more people and goods around the city, attracting new businesses, residents, jobs, and maintaining Melbourne's liveability.

Project description, the risk assessment, and the Environmental Performance Requirements

The descriptions within this chapter present a feasible and conservative design, construction and operational approach for each project which form the basis of the assessments presented in this EES.

A comprehensive risk assessment has been undertaken (see Attachment II *Environmental Risk Report*) to confirm that all the aspects of the projects, as described here, that could have significant environmental impacts are identified and sufficiently defined. Where an aspect of either project has been found to present an environmental risk, the risk has been investigated in detail to understand what the potential impact may be, and how it may be avoided, minimised or managed.

The Environmental Performance Requirements (EPRs) define the environmental outcomes that must be achieved during design, construction and operation of the Edithvale and Bonbeach level crossing removal projects, regardless of the detailed design solutions adopted. They may also represent specific measures developed in this EES to avoid, reduce or manage potential impacts.

While the key components of the projects such as the trenches, stations and new intersections would not change, the final detailed design and construction methodology may differ from what is presented here. For example, the design would seek to minimise the length of the trenches and stations would have a high quality architectural treatment. However, they would be governed by the EPRs to ensure that the environmental effects generated are consistent with, and no worse than, the impacts discussed in this EES.

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[1] *Victorian Government (2017). Level Crossing Removal Project Program Business Case.*

Victorian Government policies and plans recognise that without an immediate and major enhancement in the capacity and efficiency of the city's transport system, Melbourne's liveability, accessibility and productivity cannot be sustained. To this end, the State Government is investing in road and rail projects designed to ensure the transport system keeps pace with the city's growth into the future.

Section 5.6 of the Business Case sets out the LXRP in the broader context including the *Transport Integration Act 2010* and Victorian Government policy, guidelines and plans.

There are 178 level crossings on Melbourne's metropolitan (electrified) rail network – more than any other Australian city. Each of these crossings represents a major conflict point between rail, road and pedestrian traffic. All of them contribute to some extent to congestion, safety and amenity problems on the city's transport system and many inhibit improvements to the capacity of both the road and rail networks. Level crossings also limit opportunities for urban renewal and development.

It is clear that without some intervention, a significant number of roads across Melbourne, many of which are important commuter and freight routes, would effectively be closed for considerable periods of time if there is an increase in the frequency of train services – causing even longer delays, higher costs, greater frustration and increased safety risks.

The LXRP is a critical enabler of other major rail projects, including the Cranbourne-Pakenham line upgrade and the Melbourne Metro Rail Tunnel Project. These major projects will transform Melbourne's transport network and are expected to have a significant impact on Melbourne's city structure, by encouraging households and businesses to locate along high capacity rail corridors, due to the significant accessibility improvements these projects provide. This will deliver economic and social outcomes that will benefit the Victorian economy.

For the first time, the Victorian Government has a long-term, strategic plan for removing level crossings to systematically address the safety and congestion problems associated with this outdated feature of Melbourne's transport system, and create better connected, liveable and thriving communities.

The LXRP involves the removal of 50 level crossings, including at Edithvale and Bonbeach, in a coordinated program. Eleven level crossings have already been removed by the end of 2017, a further 13 are underway and all 50 will be removed by the end of 2022.

2.3 Benefits

The removal of the Edithvale and Bonbeach level crossings aligns with the Victorian Government's aims to improve safety, deliver benefits to the transport network and create thousands of jobs.

Melbourne's level crossings are dangerous and congested, provide the opportunity for unsafe behaviours, and place an increasing burden on the operation of both the road and rail networks. When boom gates are down, level crossings increase congestion on roads, delaying private vehicles, buses and commercial traffic.

Between 2005-2014, a third of Australia's collisions between trains and vehicles occurred in Victoria, and over half of collisions between trains and pedestrians occurred in Melbourne. There were 149 collisions between trains and vehicles or pedestrians on Melbourne's rail network that resulted in 22 serious injuries and 38 fatalities.

2.3.1 Improve transport safety in the Edithvale and Bonbeach areas

Prior to the commencement of the Level Crossing Removal Project (LXRP), there were 178 level crossings across the electrified rail network. All level crossings are dangerous, presenting safety risks to road and rail users alike, including pedestrians and cyclists. Removing any level crossing will create safer communities, significantly reducing the risk of serious or fatal collisions.

Level crossings provide opportunity for risk-taking behaviour, with people attempting to avoid delays, ignoring signals and boom gates. Twenty people died after being hit by a train between 2005 and 2014 at the 50 crossings to be removed, with more than 60 collisions and almost 700 near misses also occurring at those 50 sites.

The Edithvale and Bonbeach level crossings contributed to these safety concerns in the 10 years to 2015:

- At Edithvale, there was one fatality, one collision between a vehicle and a train, and seven near misses involving trains and pedestrians.
- At Bonbeach, there was one collision between a vehicle and train, one near miss involving a train and a pedestrian, and eleven near misses involving trains and vehicles.

Removing the Edithvale and Bonbeach level crossings would eliminate these safety concerns.

The opportunity to contribute towards safer communities arises not only from reducing the risk of accidents at these crossings, but also from providing better designed station precincts to improve safety for the community in the wider vicinity of the crossings.

The projects would create open station forecourts, with more space and better visibility and accessibility for pedestrians through removing the interface with the train lines. A shared user path along Station Street would improve safety for pedestrians and particularly for cyclists through creating off-road infrastructure that would encourage more people to cycle to the stations. Provision of modern station infrastructure would improve the user experience, and ensure a high level of *Disability Discrimination Act 1992* (DDA) compliant accessibility to the platforms.

Replacing the Edithvale and Bonbeach stations and improving the amenity would contribute to improved transport safety.

2.3.2 Reduce traffic congestion in the Edithvale and Bonbeach areas

The Edithvale and Bonbeach projects would reduce congestion through removing the level crossings and improving the station precinct design.

The level crossings at Edithvale and Bonbeach contribute to the increasing levels of congestion on Melbourne's roads, which costs the Victorian economy $3 billion every year (Victorian Government, 2017[2]). They also limit the number of train services that can operate on each line.

In the five years to May 2017, Metro Trains Melbourne (MTM) recorded approximately 1,500 incidents of signal faults at, or on the approach to, the 50 level crossings identified for removal which have resulted in the cancellation of 2,500 trains, or delay of a further 6,000 trains. This presents a significant cost to commuters, road users, and freight in terms of travel time delays and lost productivity. Types of recorded faults include issues with boom gates, warning bells and pedestrian gates, which further increase the risk of collisions, serious injury or fatalities.

Edithvale Road is a key arterial road, linking the Nepean Highway and bayside areas to Melbourne's eastern suburbs and to the Mornington Peninsula. The importance of Edithvale Road is highlighted on weekends during summer as it provides a key connection to a safe, patrolled beach. Almost 14,000 vehicles per weekday use the Edithvale Road level crossing. The boom gates are down at Edithvale Road for an average of 42 minutes during the weekday morning peak between 7:00 am and 9:00 am, significantly impacting the vehicles who use the level crossing.

Station Street/Bondi Road at Bonbeach is used by nearly 4,500 vehicles per weekday to access the suburb of Bonbeach and the arterial road network. The boom gates are down for an average of 45 minutes in the morning two-hour peak, limiting local access.

Removing the Edithvale and Bonbeach level crossings would eliminate these delays.

2.3.3 Generate local jobs and stimulate the local economy

The removal of both level crossings would generate hundreds of jobs within the local areas for the duration of the construction program. The size of the workforce would vary throughout the construction, increasing to a peak of several hundred people during the main occupation. During this time, workers would help to stimulate the local economy through supporting local businesses in both the Edithvale and Bonbeach precincts.

2.3.4 Facilitate additional train services on the Frankston rail line

Public Transport Victoria (PTV) has forecast a 42 per cent growth in the train patronage on the Frankston rail line during the two-hour morning peak period between 2015 and 2031. The increasing population is putting significant pressure on the rail network. Increasing the number of services on the corridor is constrained by many factors, including the impact to the road network and resulting congestion due to additional boom gate down time. There is a total of 30 level crossings along the Frankston line, and each of them contributes to this constraint. Removing key crossings enables additional trains to run while preserving or enhancing the operation of important roads and routes, and provides a significantly safer environment at each crossing.

Each weekday, over 200 passenger train services (112 to Melbourne and 122 from Melbourne) pass through the Edithvale and Bonbeach level crossings. Up to six freight trains to and from the Port of Hastings also use the corridor each day, and the regional trains which operate between Frankston and Stony Point periodically travel to the city for maintenance.

Removing the Edithvale and Bonbeach level crossings would contribute to enabling more train services on the Frankston rail line.

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[2] *Victorian Government (2017). Level Crossing Removal Project Program Business Case.*

2.4 Project development

The development of each project has progressed across the following key phases:

- **Preliminary options assessment** – A number of options for removing the level crossings were investigated.
- **Design solution** – The 'rail under road' or 'trench' option was selected for the Edithvale and Bonbeach level crossing removals as a result of technical assessments, environmental considerations and a comprehensive community consultation program.
- **Design** – The design was developed further, alongside environmental investigations to inform the EES.

Across each of the development phases, the projects' designs were refined through an iterative process involving technical and environmental assessments and community and stakeholder consultation. This process has ensured the objectives of the projects are met, that the relevant legislative and policy requirements are addressed and the potential risks and adverse environmental impacts are minimised.

2.4.1 LXRP Business Case

The LXRP Business Case describes that a wide range of potential options were reviewed, assessed and refined to establish a budget envelope for delivering a credible range of options at each level crossing removal site.

Relevant to the Edithvale and Bonbeach level crossing removal projects, an Options Assessment Framework was developed to assess and shortlist a range of options at each site in a consistent manner that meets the LXRP objectives and timelines. The application of the framework resulted in the identification of a feasible solution for the removal of the level crossing (such as rail under road or road over rail), plus the Metropolitan Network Modernisation Program improvements (including new train stations, improved public transport access, and new pedestrian and cycling links) and amenity improvements such as landscaping and streetscape improvements. The Business Case recognised that there may be other feasible options for removing level crossings at some sites.

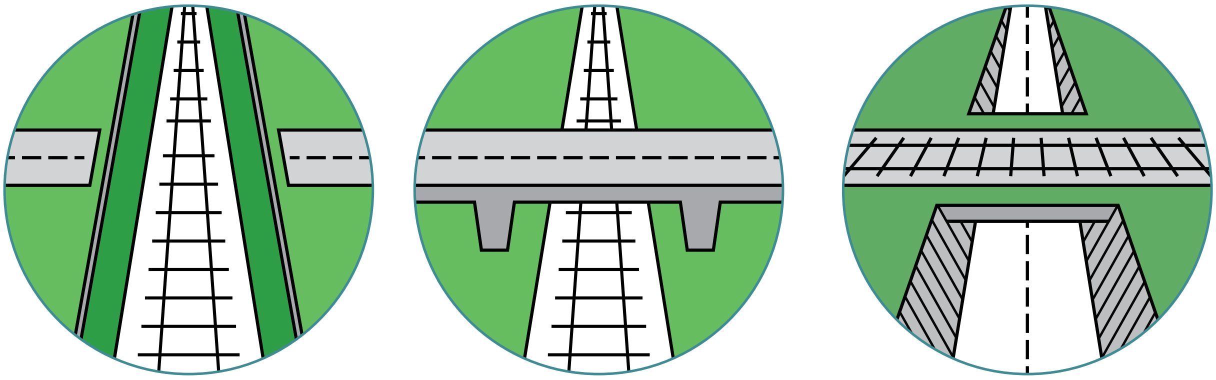
Further detailed investigation and public consultation was conducted to inform the recommended solution. Opportunities to provide integrated development of state-owned land within and nearby existing rail and road corridors as part of the LXRP were also considered, but no opportunities have been identified for the Edithvale and Bonbeach projects.

2.4.2 Why a rail trench under the road?

A number of options for removal of the level crossings were investigated for Edithvale and Bonbeach, including:

- **Closure** of Edithvale Road and/or Station Street/Bondi Road (refer Figure 2.1A).
- **Road over rail:** This option would involve raising the road over the rail line with the existing rail line to remain at grade (refer Figure 2.1B).
- **Road under rail:** This option would involve building a new road underpass with a rail bridge over the road to retain rail levels (refer Figure 2.1C).
- **Rail over road:** This option would involve raising the rail line onto a rail bridge or embankment, with a rail bridge over the road (refer Figure 2.1D).
- **Rail under road:** This option would involve lowering the rail line beneath the existing road. A new bridge would be built to maintain the road at its existing level (refer Figure 2.1E).
- **Hybrids:** Hybrid solutions involve changing the grades of both the road and rail to reduce the height of the elevated infrastructure. Options include either:
  - Lowering the road and elevating the rail.
  - Lowering the rail and elevating the road.

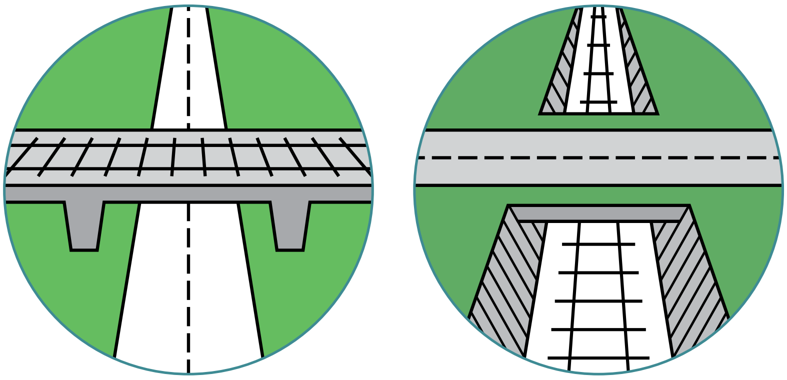
Figure 2.1 Level crossing removal options considered



A: Road closure

B: Road over rail – elevated structure (rail remains at grade)

C: Road under rail – trench (rail remains at grade)



D: Rail over road – elevated structure (road remains at grade)

E: Rail under road – trench (road remains at grade)

These options were explored to assess their feasibility. It was found that although technically feasible:

- **Closure of roads** (Figure 2.1A) essentially represents the boom gates remaining permanently lowered, preventing road vehicles from crossing the rail corridor. This would significantly increase traffic congestion as the vehicles that currently use the Edithvale and Bonbeach level crossings would be redirected to, and increase congestion and safety risks at other crossings in the area such as at Chelsea Road and Lochiel Avenue. Edithvale Road is a declared arterial road linking Edithvale and surrounding suburbs to the Nepean Highway, the Mornington Peninsula Freeway (M11) and to Melbourne's eastern suburbs via Springvale Road, Eastlink and Westall Road, and serves as a key strategic route. Station Street/Bondi Road provides a critical connection for the Bonbeach suburb to the arterial road network. Closing both or either would result in a poor outcome for the road network.
- **Changing the elevation of the existing roads** (i.e. road over rail, road under rail and hybrid options) (Figure 2.1B and Figure 2.1C) were considered less desirable than altering the rail corridor. They would require changes to road elevations resulting in:
  - complex and potentially unsafe road geometries
  - significant land acquisition of residential properties to maintain connectivity from (for example) Edithvale Road to Station Street
  - negative impacts for the surrounding urban form and local connectivity.

  The impacts of acquisition to private property, and potentially commercial premises, were considered too great to consider these options further.

The 'rail over road' (Figure 2.1D) and 'rail under road' (Figure 2.1E) options were considered feasible and short-listed for presentation to the community in a series of comprehensive consultation sessions over a 12-month period, as discussed in Chapter 12 *Stakeholder and community engagement*.

The 'rail under road' option (Figure 2.1E) was selected for both the Edithvale and Bonbeach level crossing removals following the consideration of outcomes from a series of technical and preliminary environmental assessments, and social considerations that were identified during the comprehensive stakeholder and community consultation program.

The proposed option was selected following consideration of:

- Alignment with LXRP objectives, including more efficient and reliable transport networks, better connected, liveable, safer and thriving communities.
- Project outcomes including cost, time and delivery risk, urban design standards and protection of future assets.
- Project impacts including land acquisition and land use impacts, environmental impacts and temporary impacts during construction.

The following sections describe the rail under road (trench) proposed option for each project.

2.4.3 Technical design constraints

Rail and road design must adhere to strict parameters as discussed where applicable in Sections 2.5 and 2.6. This sets constraints on the technical design for safety and operational reasons including:

- maximum track gradients of two per cent
- minimum clearances between the tracks and the underside of bridges and other structures of 5.75 metres
- maintaining access in accordance with the *Disability Discrimination Act 1992* (DDA)
- replacement of pedestrian crossings in their current locations.

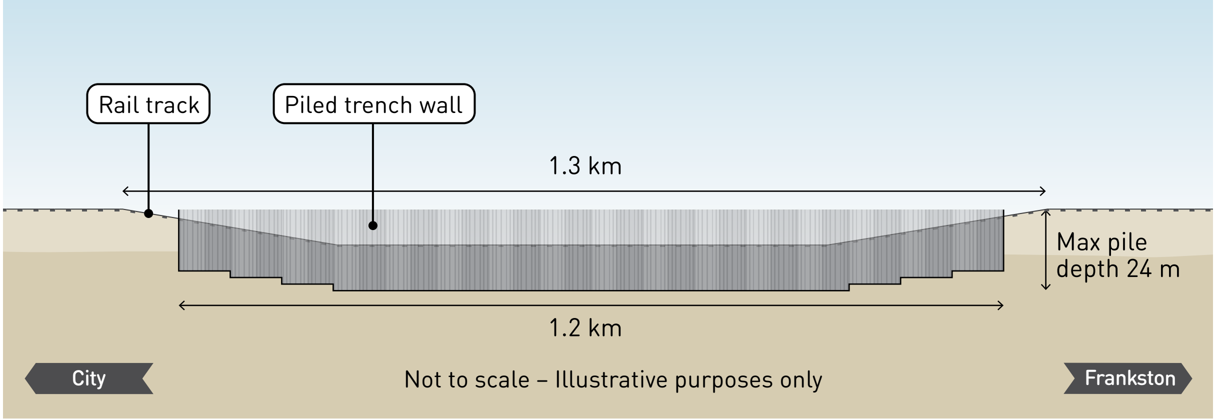
2.5 Edithvale level crossing removal project

This section outlines the key components of the Edithvale level crossing removal project, including a trench, railway station, and ancillary infrastructure.

2.5.1 Rail trench

The removal of the level crossing at Edithvale Road, Edithvale where it crosses the Frankston rail line is proposed to occur through lowering the rail line into a trench up to 1,300 metres long located between Lochiel Avenue and Berry Avenue. The trench would require installation of up to 1,200 metres of piles along both sides of the trench to varying depths in a configuration such as that shown in Figure 2.2. Refer to the text box on page 2.15 for a description of piling.

Figure 2.2 Indicative profile of the trench walls at Edithvale



The length and depth of the trench are determined by a number of factors, including:

- A maximum track gradient of two per cent, with the Lochiel Avenue level crossing constraining the northern extent of the trench.
- A required 5.75 metre clearance between the tracks and the underside of the Edithvale Road Bridge, such that the final level of the tracks would be approximately 8 metres below ground level.
- The depth of the base slab and water storage tank is such that the maximum depth of excavation required is approximately 14 metres below ground level.

In terms of width, the trench is constrained by the width of the rail corridor between Nepean Highway and Station Street. At its widest point, the trench would be up to 24 metres wide (including the width of the piles, tracks and island platform), and narrow to approximately 14 metres at both ends.

2.5.2 Edithvale Railway Station

The existing station would be demolished and replaced with new station infrastructure. At street level, on a deck over the trench on the north side of Edithvale Road, a new station building would be constructed with ticketing and bicycle storage facilities, potential for a small-scale retail space and provision of facilities for potential future use by Protective Services Officers.

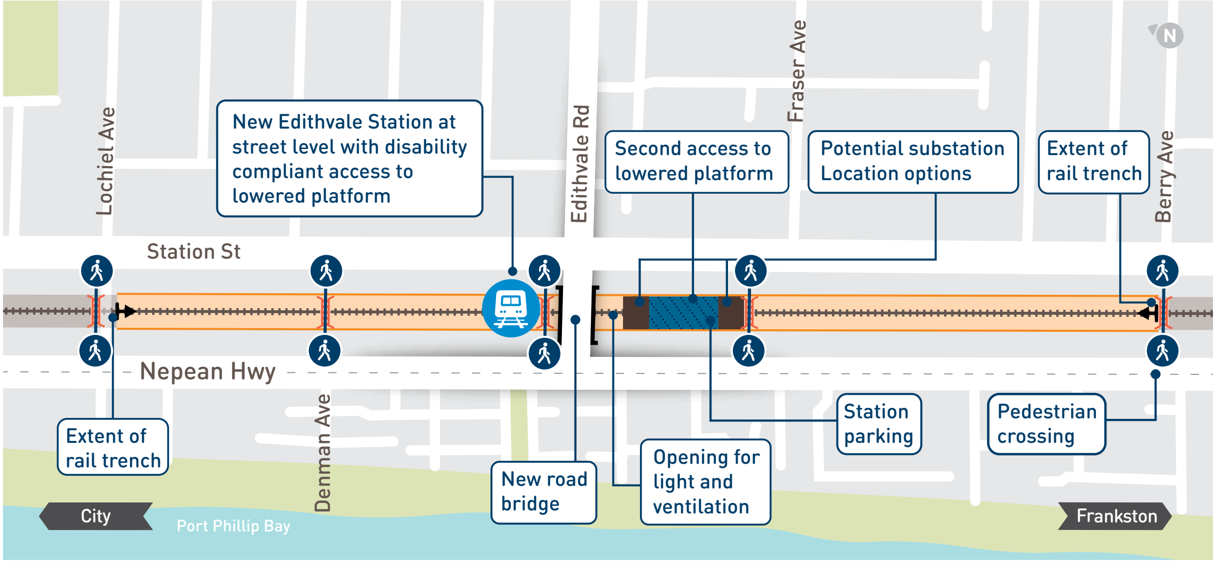
The station precinct would also include 38 car park spaces (34 for commuters, one for disabled use, two for staff and one for emergency vehicles) on a deck over the trench to the south of Edithvale Road, accessed from Station Street. The number of spaces provided represents no net loss of commuter parking relative to the existing conditions, while other informal commuter car parking and short-term car parking will be provided along Station Street and Nepean Highway.

DDA compliant access will be provided to the new island platform situated in the trench and between the tracks.

The car park deck would be offset from Edithvale Road to create a void over the platforms. Maintaining a void would enable passive ventilation of the platform area, improving amenity and sustainability outcomes (i.e. reduced energy demands).

Project components are shown conceptually in Figure 2.3.

Figure 2.3 Schematic design for Edithvale


Lochiel Ave
New Edithvale Station at street level with disability compliant access to lowered platform
Edithvale Rd
Second access to lowered platform
Fraser Ave
Potential substation Location options
Extent of rail trench
Berry Ave
N
Station St
Nepean Hwy
Extent of rail trench
Denman Ave
New road bridge
Opening for light and ventilation
Station parking
Pedestrian crossing
City
Port Phillip Bay
Frankston

2.5.3 Railway infrastructure and utilities

New rail infrastructure to be reinstated includes the tracks, electrical and signalling systems. In addition, a new electrical substation would be required to address the increased power demand for trains on the Frankston corridor. The substation would be enclosed within security fencing and consist of a prefabricated building with an approximate footprint of 35 metres long, seven metres wide and six metres tall. Two options have been identified for the location of the substation, as shown in Figure 2.3. Each option is adjacent to the proposed car park deck over the railway (north or south of the car park deck) such that the total length of this deck would be approximately 140 metres long.

To protect the trench, and ensure safety for the community at street level, a 0.8 to 1.8 metre tall concrete crash barrier would be required along the top of the trench. A screen to prevent items being thrown onto the railway would be included on top of the crash barrier up to a total height of 2.4 metres.

While not railway infrastructure, the corridor currently accommodates utility services such as electrical and telecommunication services for the surrounding community. These would require relocation in consultation with the utility owners who would undertake the relocation works. Other services that may require relocation include gas, water and sewerage. Works to relocate services would occur under separate approvals outside the scope of this EES.

2.5.4 Road, cyclist and pedestrian infrastructure

Edithvale Road would be reinstated in its existing location on a road bridge over the trench. Some modifications of the layouts and signalling at the Station Street and Nepean Highway intersections may be required to balance the needs of the general traffic, public transport, cyclists and pedestrians. Intersection modifications would be informed by traffic analysis and consultation with Kingston City Council (Council) and VicRoads during the detailed design phase of the project.

Bus stops on Station Street and Edithvale Road would be retained, however, changes to the intersection layouts could require minor relocation of bus stops.

A shared user path (for pedestrians and cyclists) would be provided alongside the trench on Station Street to improve safety and access in and around the new station precinct.

Cross-corridor connectivity would be retained through the provision of two DDA compliant bridges over the trench, with a third such crossing incorporated at grade into the car parking deck. The locations of these bridges would be confirmed in consultation with Council and incorporate community feedback, and require:

- a 2.4 metre barrier where bridges cross the railway to comply with railway standards and maintain public safety
- a clearance of 5.75 metres above the tracks, such that the closer they are to the end of the trench, the higher they need to be and the longer the DDA compliant ramp.

2.5.5 Surface water management

The trench would be designed to prevent groundwater from entering the trench and avoid the need for ongoing dewatering. However, rain would fall into the trench and require management.

A stormwater tank would be incorporated into the base of the trench to meet MTM requirements for accommodating rainfall equivalent to a 1 in 100-year two-hour storm. This equates to a volume of up to 800 cubic metres, including an allowance for the climate change scenario discussed in Section 2.9. The design solution for discharging and treating collected stormwater would be developed in conjunction with Council and Melbourne Water to ensure the project meets stormwater management requirements.

2.5.6 Groundwater management

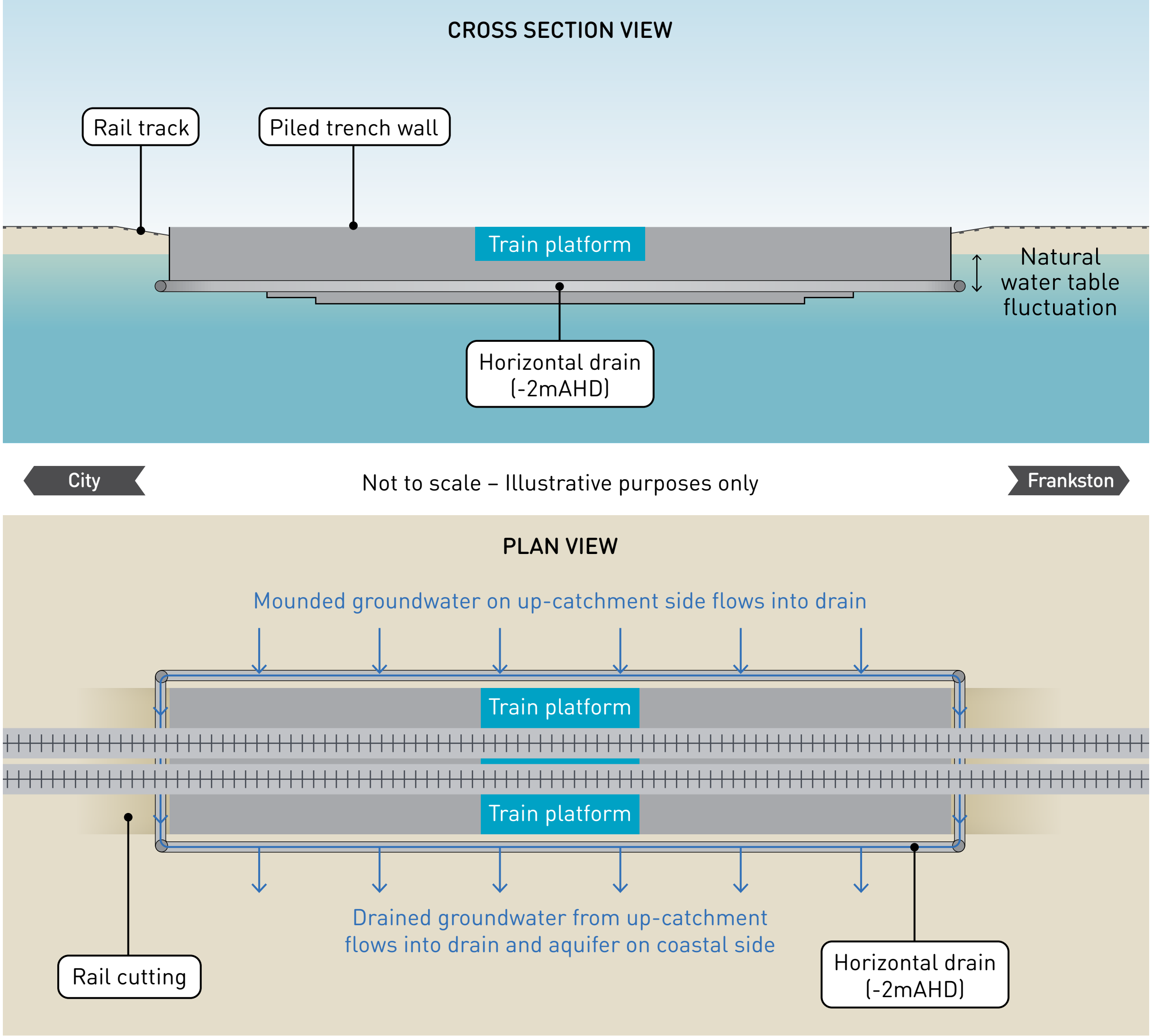
Through the risk and impact assessment process, a need to manage groundwater was identified to reduce the potential changes to groundwater levels and the associated impacts.

To manage potential impacts predicted through the initial assessment, an EPR was developed which would reduce the magnitude and extent of project-induced groundwater level changes at Edithvale. As outlined in Chapter 5 *Modelling the water environment*, an engineering solution was developed and modelled to demonstrate that a mitigation measure could be adopted to minimise the impact of the project on groundwater levels to achieve the performance outcomes in EPR_GW2 (refer Chapter 9 *Environmental Management Framework*).

The engineering solution modelled for this EES comprises the installation of a passive horizontal drain, which is an underground pipe that would be installed around the outside of, and adjacent to, the pile walls. The pipe would be installed at a depth that is permanently below the naturally variable water table, and perforated to allow groundwater inflow and outflow.

Without the engineering solution, the groundwater levels 'upstream' of the trench (i.e. inland) would rise, and drop on the 'downstream' side of the trench. The passive horizontal drain would provide a permeable connection between both sides of the trench, allowing groundwater to move more freely around the trench and minimise the difference in groundwater levels on either side of the trench. Figure 2.4 provides a schematic representation of the passive horizontal drain.

Figure 2.4 Schematic representation of the passive horizontal drain


CROSS SECTION VIEW
Rail track
Piled trench wall
Train platform
Natural water table fluctuation
Horizontal drain (-2mAHD)
City
Not to scale – Illustrative purposes only
Frankston
PLAN VIEW
Mounded groundwater on up-catchment side flows into drain
Train platform
Train platform
Drained groundwater from up-catchment flows into drain and aquifer on coastal side
Rail cutting
Horizontal drain (-2mAHD)

The engineering solution developed for this EES demonstrates that EPR_GW2 could be achieved to mitigate the potential impacts predicted at Edithvale. Prior to construction of the trench, an independent peer review would be undertaken by appropriately qualified specialists to confirm that the proposed engineering solution, or any variation or alternative to it, would achieve EPR_GW2. The rationale and further discussion regarding the effectiveness of this solution and EPR_GW2 is discussed in Chapter 5 *Modelling the water environment*.

2.5.7 Urban design

All aspects of the proposed project, including the station buildings, barriers and screens, car parking, substation and landscaping would be designed in accordance with the Urban Design Guidelines discussed in Chapter 11 *Urban design approach* and presented in Attachment VII *Urban Design Guidelines – Edithvale*.

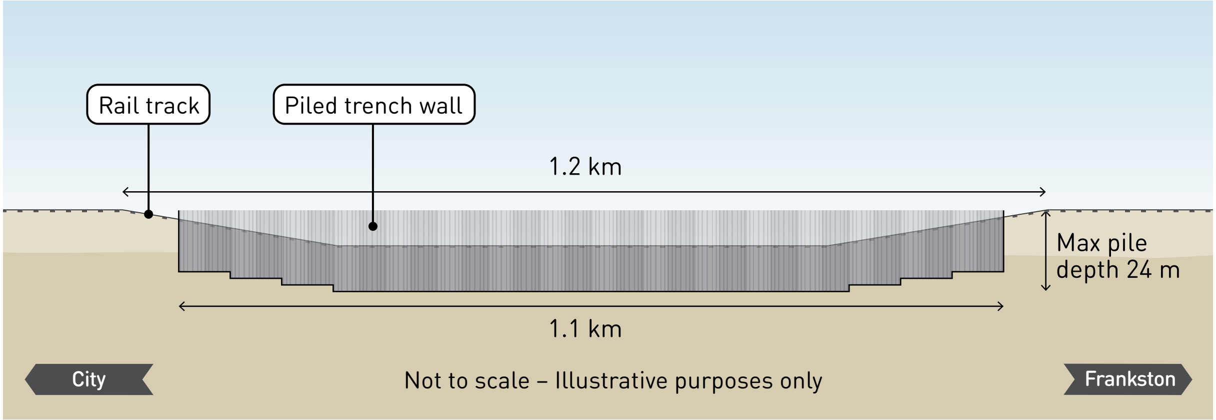
2.6 Bonbeach level crossing removal project

This section outlines the key components of the Bonbeach level crossing removal project, including a trench, railway station, and ancillary infrastructure.

2.6.1 Rail trench

The removal of the level crossing at Station Street/Bondi Road, Bonbeach where it crosses the Frankston rail line is proposed to occur through lowering the rail line into a trench up to 1,200 metres long located between Golden Avenue and The Glade. The trench would require installation of piles along both sides of the trench to varying depths in a configuration such as that shown in Figure 2.5.

Figure 2.5 Indicative profile of the trench walls at Bonbeach



The length and depth of the trench are determined by a number of factors, including:

- A maximum track gradient of two per cent.
- A required 5.75 metre clearance between the tracks and the underside of the Bonbeach Road Bridge, such that the final level of the tracks would be approximately 8 metres below ground level.
- The depth of the base slab and water storage tank is such that the maximum depth of excavation required is approximately 14 metres below ground level.

In terms of width, the trench is constrained by the width of the rail corridor between Nepean Highway and Station Street. At its widest point, the trench would be up to 24 metres wide (including the width of the piles, tracks and island platform), and narrow to approximately 14 metres at both ends. The trench would be within the existing rail corridor.

2.6.2 Bonbeach Railway Station

The existing station would be demolished and replaced with new station infrastructure. At street level, on a deck over the trench on the north side of Station Street/Bondi Road, a new station building would be constructed with ticketing and bicycle storage facilities.

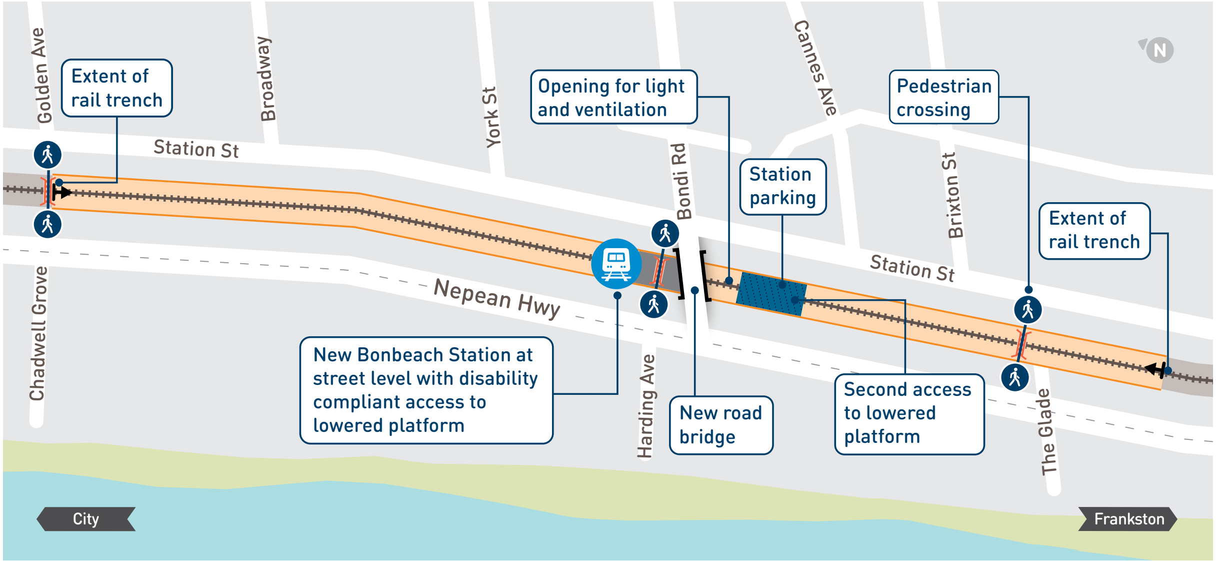
The station precinct would also include 39 car park spaces (35 for commuters, one for disabled use, two for staff and one for emergency vehicles) on a 90 metre deck over the trench to the south of Station Street/Bondi Road, accessed from Station Street. The number of spaces provided represents no net loss of commuter parking relative to the existing conditions, while other informal commuter car parking and short-term car parking will be provided along Station Street and Nepean Highway.

DDA compliant access will be provided to the new island platform situated in the trench and between the tracks.

The car park deck would be offset from Station Street/Bondi Road to create a void over the platforms, for the same reasons as described for Edithvale station.

Project components are shown conceptually in Figure 2.6.

Figure 2.6 Schematic design for Bonbeach



2.6.3 Railway infrastructure and utilities

New rail infrastructure to be reinstated includes the tracks, electrical and signalling systems.

To protect the trench, and ensure safety for the community at street level, a 0.8 to 1.8 metre tall concrete crash barrier would be required along the top of the trench. A screen to prevent items being thrown onto the railway would be included on top of the crash barrier up to a total height of 2.4 metres.

While not railway infrastructure, the corridor currently accommodates utility services such as electrical and telecommunication services for the surrounding community. These would require relocation in consultation with the utility owners who would undertake the relocation works. Other services that may require relocation include gas, water and sewerage. Works to relocate services would occur under separate approvals outside the scope of this EES.

2.6.4 Road, cyclist and pedestrian infrastructure

Station Street/Bondi Road would be reinstated in its existing location on a road bridge over the trench. Some modifications of the layouts and signalling at the Station Street and Nepean Highway intersection may be required to balance the needs of general traffic, public transport, cyclists and pedestrians. Intersection modifications would be informed by traffic analysis and consultation with Council and VicRoads during the detailed design phase of the project.

Provision would be made on Station Street for bus stops to be added in the future.

A shared user path would be provided alongside the trench on Station Street to improve safety and access in and around the new station precinct.

Cross-corridor connectivity would be retained through the provision of two DDA compliant bridges over the trench. The locations of these bridges would be confirmed in consultation with Council and incorporate stakeholder and community feedback, and require:

- a 2.4 metre barrier where bridges cross the railway to comply with railway standards and maintain public safety
- a clearance of 5.75 metres above the tracks, such that the closer they are to the end of the trench, the higher they need to be and the longer the DDA compliant ramp.

2.6.5 Surface water management

The trench would be designed to prevent groundwater from entering the trench and avoid the need for ongoing dewatering. However, rain would fall into the trench and require management.

A stormwater tank would be incorporated into the base of the trench to meet MTM requirements for accommodating rainfall equivalent to a 1 in 100-year two-hour storm. This equates to a volume of up to 800 cubic metres, including an allowance for the climate change scenario discussed in Section 2.9. The design solution for discharging and treating collected stormwater would be developed in conjunction with Council and Melbourne Water to ensure the project meets stormwater management requirements.

2.6.6 Groundwater management

An engineering solution, similar to that proposed at Edithvale, is not considered necessary at Bonbeach as the direction of groundwater flow is different. The pile wall configuration proposed (shown indicatively in Figure 2.5) includes measures that minimise potential impacts to groundwater, including stepped depths of impermeable piles. The stepped pile depths provide the necessary structural support for the trench while minimising the extent to which the piles extend into the groundwater and the associated disruption to groundwater flow. For further information and the outcomes of the impact assessment in relation to this see Chapter 5 *Modelling the water environment.*

2.6.7 Urban design

All aspects of the proposed project, including the station buildings, barriers and screens, car parking, substation and landscaping would be designed in accordance with the Urban Design Guidelines discussed in Chapter 11 *Urban design approach* and presented in Attachment VIII *Urban Design Guidelines – Bonbeach.*

2.7 Construction

This section discusses the construction elements across the two projects. As both projects would occur concurrently, there is a high level of commonality between the two projects, and the following discussion therefore applies to both projects unless otherwise specified.

Key construction activities and requirements for the projects are outlined in the sections below and provide the basis for preparing the EES and assessing the potential impacts of the projects. Construction details would be subject to further refinement as the projects progress, however any changes to the activities and requirements outlined below would need to be in accordance with the EPRs set out in Chapter 9 *Environmental Management Framework*.

2.7.1 Construction activity

There are four phases to the construction activity, which are anticipated to take a total of 18 months. The four phases are:

- site establishment and services relocation
- piling
- main rail occupation
- completion.

The Frankston rail service would continue to run during all but the occupation phase, except for occasional overnight and weekend disruptions when buses would replace trains.

An indicative schedule is presented in Section 2.7.5.

Site establishment and services relocation

A program of preparatory and ancillary works includes identification and relocation of utility services such as water, electricity, gas and telecommunications. These would be undertaken to ensure there are none within the construction areas prior to commencement of major construction activities. This work would be undertaken in conjunction with, and delivered by, the affected utility service provider in accordance with their usual processes and are outside the scope of this EES and associated project approvals.

Preparatory and ancillary works typically include activities such as:

- Removal of vegetation within the project footprints.
- Establishment of necessary access points and haul routes alongside the tracks and/or a level base from which to operate the piling rig, including removal of fencing and other necessary infrastructure.
- Establishment of on-site offices and staff amenities, site fencing and way-finding signage where necessary around works to ensure the safety and security of the community (including train operations), plant and equipment, and the workforce.
- Undertaking further soil investigations to inform detailed design and construction methods.
- Establishment of environmental and traffic management controls.

To assist with the site preparatory works and services relocation works, short term closures of the rail line (i.e. overnight or weekend) and traffic restrictions may be required from time to time.

Piling phase

The main construction task to be completed prior to the main rail occupation would be the piling associated with the walls of the trench.

The piles along both sides of each trench would be installed progressively while trains are running. Piling rigs operating on the Nepean Highway side of the rail corridor would likely require temporary closure of the easternmost traffic lane and any adjacent car-parking in the vicinity of the rig. Rigs on the Station Street side would also require temporary occupation of parallel car-parks, where they exist, and some temporary lane closures. The temporary lane closures would move along the corridor with the rig as piling works progressively move along the rail corridor.

Piling across Edithvale Road and Station Street/Bondi Road would require temporary short-term closure of these roads at the level crossing. Alternative routes would be advertised prior to the closure of the roads. Short term closures of the rail line (i.e. overnight or weekends) may also be required from time to time.

What is a pile?

A pile or piling is a vertical structural element of a foundation, driven or drilled into the ground.

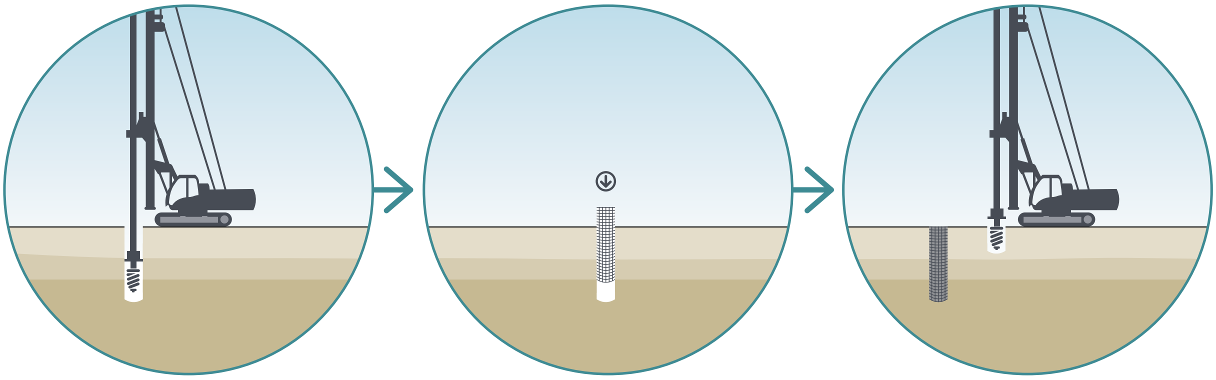
For the trenches associated with the Edithvale and Bonbeach projects, the piled wall is likely to be constructed using concrete piles. A hole is drilled (or 'bored') into the ground and the soil is removed prior to filling the hole with steel reinforcement and concrete.

This type of pile would have no impacts associated with vibration. However, alternative piling types could be used that consist of either steel 'sheet' piles, or 'driven' piles.

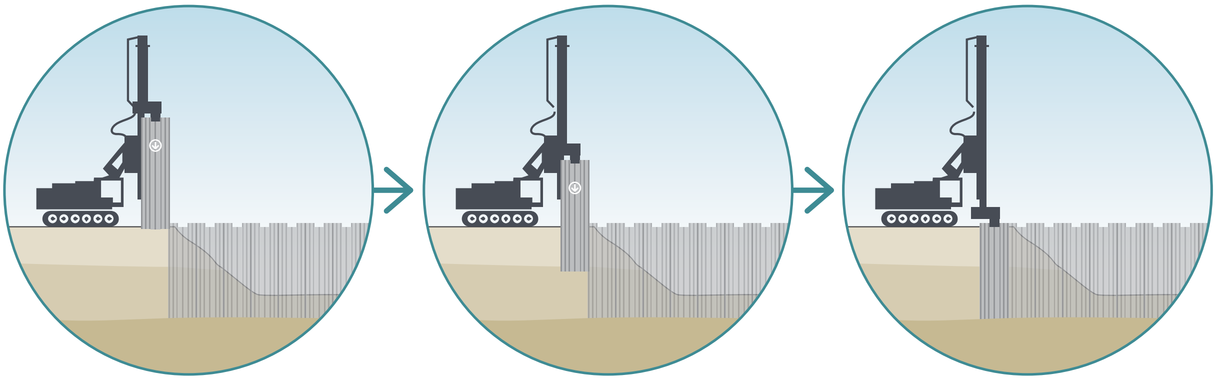
The piles would either be hammered or vibrated into the ground. These alternative retaining wall types have also been considered as part of the EES.

All of these various types of piling would have a common feature, being that they would form a watertight structure preventing ground water from entering the rail trench where the extent of the trench is beneath the water table. Piling methods are shown schematically in Figure 2.7.

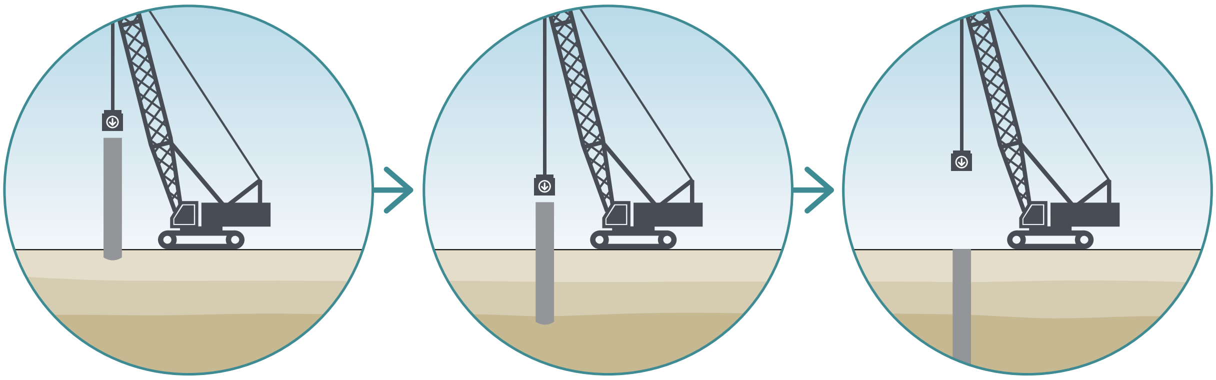
Figure 2.7 Piling methods: (a) bored pile; (b) sheet pile; (c) driven piles



A: Bored pile



B: Sheet pile



C: Driven pile

Main rail occupation

The overall closure or 'occupation' of railway infrastructure is expected to be 10 weeks.

This includes four weeks to remove the existing Edithvale and Bonbeach Stations and six weeks to excavate the trenches, lay new tracks and commission new infrastructure.

Approximately four weeks prior to excavation of the trenches, the existing Edithvale and Bonbeach train stations would be closed and demolished to facilitate the completion of piling in these areas. During this four-week period prior to the main occupation trains would still run, however, passengers who use these two stations would be required to use alternative stations nearby.

The main six-week rail occupation would require the closure of the railway between Frankston and Mordialloc (refer text box), and during this period, a train replacement bus service would be provided.

Major construction activities include:

- removal of existing rail and road infrastructure
- construction of the Edithvale Road and Station Street/Bondi Road bridges
- excavation of the trench and construction of the base slab and waterproofing. It is anticipated that the excavation to construct the trench would take approximately two weeks, subject to weather
- construction of new platforms and new station infrastructure
- installation and commissioning of new rail infrastructure (i.e. ballast, rail, power, signalling).

Activities would occur 24 hours a day, seven days a week until rail services resume at the completion of the rail occupation.

The anticipated six-week duration of the main rail occupation is subject to detailed design, construction staging and weather. The time of year has yet to be determined, and would be identified in conjunction with relevant stakeholders, including Public Transport Victoria, MTM, other level crossing projects and Melbourne Metro Rail Authority.

Why will the railway be closed between Frankston and Mordialloc

Trains cannot run while certain construction activities are being undertaken including excavation, construction of new stations and relocation of services in the rail corridor.

There is not sufficient space in the rail corridor to construct new tracks adjacent to the proposed trenches to enable services to continue during excavation and construction of new station infrastructure.

It is therefore necessary to close the railway while these works are undertaken. This means a bus service would operate between Frankston and Mordialloc.

It is not possible to run trains further south than Mordialloc because the infrastructure required to terminate trains and move them from the south bound track to the north bound track is only available at Mordialloc.

The majority of the works during the site establishment and piling phase can be undertaken without closing the rail corridor and interrupting passenger and freight services. However, there would be periodic and unavoidable closures required from time to time, for works such as the relocation of some services and other works where it may not be possible or safe to continue railway operations. These closures would typically occur overnight or during weekends.

Completion phase

Following the main rail occupation, the level crossings would have been removed with trains resuming service through the trenches. Further activities would be required as part of project completion works such as landscaping, car parking, pedestrian/cycle paths and the train station fit out.

2.7.2 Construction hours and workforce

Site establishment, services relocation and piling phases

Site preparation and piling works would occur during normal day time hours, defined by the EPA Victoria Noise Control Guidelines (Publication 1254) as:

- 7:00 am to 6:00 pm weekdays
- 7:00 am to 1:00 pm Saturdays.

There may be times when unavoidable works would be required outside of these hours, such as oversized deliveries to site, works that have to occur outside those hours to minimise disruption to road and rail users, or completion of concrete pours that commence prior to 6:00 pm.

The construction workforce would be expected to be between approximately 50 to 150 people per day for these works.

Main rail occupation

Works during the main occupation at both project locations and each construction compound would occur 24 hours a day, seven days per week for the six week duration estimated for the main occupation. The construction workforce may peak in the order of 200 personnel per day during the main occupation. This would be expected to reduce steadily over four to five months following the main occupation through to completion.

2.7.3 Construction traffic

Site establishment, services relocation and piling phases

Prior to any works occurring on site, a construction management plan would be developed including a traffic management plan.

Construction works and staging, including material deliveries and parking for the workforce would be planned so that construction traffic disruptions are kept to a minimum and access would be provided to nearby residents and businesses.

Main rail occupation

During the main occupation, the number of vehicle trips to each project would be expected to peak between 1,300 and 1,600 vehicles per day during the first half of the occupation. This includes vehicles of all types, with approximately 1,000 trucks per day removing spoil and 300 staff vehicles moving between construction compounds and each site. In addition, the project would be expected to generate 300 to 500 vehicles trips per day associated with workers travelling to and from work. For the remainder of the occupation, vehicle numbers between 400 and 600 per day would be expected, comprising the workforce, supervisors and material deliveries.

Vehicle movements between the construction compounds and the sites would follow a predetermined route in accordance with a traffic management plan to be prepared prior to construction.

2.7.4 Construction work sites

To minimise disruption at and around the two project sites, one or more separate site compounds (or 'laydown areas') would be established for site offices, storage of materials and plant, amenities for workers, secure container storage, short-term storage for waste and potentially workforce parking. The laydown area(s) would be required to be in use for all of the anticipated 18 month construction duration.

Currently such a site has not been identified. Following the engagement of a contractor, they would identify one or more sites that are suitable for this purpose. Selection and operation of such a site is commonplace for construction projects such as these.

The two project sites are well served by arterial roads with Nepean Highway adjacent to the rail corridor, and Edithvale Road providing connection to Eastlink, Mornington Peninsula Freeway, Springvale Road and other arterial roads. While the location of the laydown areas is not yet known, the traffic movements between the laydown area(s) and the project areas can occur, mainly via roads intended for heavy vehicle use.

The assessments presented in this EES do not consider laydown areas. Depending on the site(s) selected, a separate planning approval process may be required which would need to be informed by site investigation and consultation.

The laydown area(s) would be reinstated following works to their pre-project condition, or as agreed with the landholder. The nature of reinstatement and any improvement works would be agreed with the landowner and other stakeholders, potentially including (but not necessarily limited to) Council and VicRoads.

2.7.5 Indicative construction schedule

An indicative construction schedule for the concurrent delivery of both projects is shown in Figure 2.8.

Figure 2.8 Indicative construction schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Laydown area(s) in use	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Site establishment and services relocation																		
Site establishment	■																	
Services relocation		■	■	■	■													
Piling																		
Piling			■	■	■	■												
Main rail occupation																		
Remove infrastructure, excavation of trench, construction of road bridge and rail infrastructure							■	■										
Completion																		
Completion of train station and car park deck; Substation									■	■	■							
Completion works and clean-up of sites (local and arterial roads, shared user path, pedestrian bridge installation, landscaping, lighting, site remediation)												■	■	■	■	■	■	■

2.7.6 Waste and spoil management

Approach

Spoil is defined as waste soil or rock resulting from excavation activities. The anticipated volume of spoil within each trench (including piling and stormwater storage) is approximately 140,000 cubic metres. As soil is excavated it de-compacts (or 'bulks up'), so that the total volume of soil to be managed is conservatively assumed to be approximately 180,000 cubic metres. This EES has considered the conservative bulked volume to ensure that mitigation measures for waste and spoil management would be effective.

Spoil generated by construction activities would be managed in accordance with the waste management hierarchy as defined in the *Environment Protection Act 1970* (Vic). This designates the most to least preferable treatments for waste, as follows:

- **Avoidance**: not feasible given the proposal is to build a trench, however the design would ensure that spoil volumes are minimised
- **Re-use**: opportunities for re-use would be explored prior to the commencement of works, however the sandy nature of soils is not generally suitable for reuse where soil is required to have a structural element (i.e. fill under road or rail embankments)
- **Recycling**: this has similar challenges as the re-use of spoil
- **Recovery of energy**: not applicable for soils
- **Treatment**: this is required if spoil is contaminated. It may be required prior to re-use or disposal, subject to opportunities available and capacity or requirements of licenced disposal sites
- **Containment**: not feasible given the proposal is to build a trench
- **Disposal**: disposal to landfill facilities licenced to receive soils of the type excavated for these projects.

Those options considered feasible and practicable for spoil management, in order of preference include re-use or disposal (with treatment, if required).

Landfill facilities exist and a number of these have been identified as suitable for receiving the spoil from the two projects based on current and forecast capacity. However, in consideration of other major infrastructure projects that would concurrently be under construction (including the Melbourne Metro Rail Tunnel Project and West Gate Tunnel Project), the landfill facility to be used would be determined just prior to the commencement of construction.

The final disposal strategy would be developed in accordance with EPA Victoria requirements, particularly in regard to managing any contamination, acid sulfate soils, and groundwater entrained within the soil, and whether spoil would be stockpiled or taken immediately to landfill. Haulage routes would follow Station Street to the nearest designated arterial road, then follow arterial roads to the ultimate re-use or disposal site. Where roads other than Station Street or designated arterials are required to be used, this would be done in consultation with VicRoads and the relevant local authority, with appropriate notice given to any affected residents.

2.8 Operation and maintenance

When complete, the rail infrastructure would be owned by VicTrack and operated in accordance with VicTrack's network demand and environmental management system. The operation of the network is outside LXRA's control, however it is an important consideration in the design and assessment of the projects to understand the potential impacts of the projects following completion. Ongoing monitoring and associated mitigation requirements set out by the EPRs would be implemented following completion of the projects by the relevant organisation.

Given the proposed change in the rail gradients that would result from the construction of the rail trench, it is anticipated that diesel services, including freight trains, may increase the 'notch' (i.e. power or throttle) setting of engines on the inclines as they exit the trench. Assessments within this EES have been undertaken on this basis to present a more conservative assessment.

Maintenance of the infrastructure would be undertaken in accordance with existing requirements.

2.9 Addressing sustainability and climate change within project designs

2.9.1 Sustainability

The projects would be designed and delivered to meet sustainability standards under two assessment tools:

- Minimum 4 star rating under the Green Building Council of Australia (GBCA) Green Star rating tool, applicable to stations.
- 'Excellent' rating under the Infrastructure Sustainability Council of Australia (ISCA) Infrastructure Sustainability (IS) rating tool, applicable to non-station infrastructure.

These tools and the standards that the projects would achieve against each are discussed in Chapter 10 *Sustainability and climate change*.

2.9.2 Climate change

The longevity of the infrastructure requires consideration of climate change projections so that the design of each project ensures that future climate change would not threaten the viability of the infrastructure.

LXRA has adopted the following scenario set out by the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (CSIRO, 2015; Grose et al., 2015):

- The Representative Concentration Pathway (RCP) 8.5 scenario as it relates to projected climate conditions in 2090.

While these scenarios are used to model a broad array of climate variables (i.e. temperature, wind speeds, evaporation and soil moisture), the key variables are rainfall intensity and sea level rise. LXRA, in consultation with Melbourne Water as the relevant authority in regard to flood management, require that the two projects address Scenario RCP8.5 as extrapolated to 2100. This is consistent with Melbourne Water's *Planning for Sea Level Rise Guidelines 2017* which apply scenario RCP8.5 and identify the following key metrics, relative to current local conditions, that are to be addressed within the designs:

- an increase in rainfall intensity of 19 per cent by 2100
- sea level rise of 0.8 metres over and above the existing 1 in 100-year flood levels.

The design presented within this chapter, and the assessments presented in this EES and supporting technical reports, incorporate these projections as appropriate (for example, the surface water management systems discussed in Sections 2.5.5 and 2.6.5).

To ensure that a broader array of climate change factors would be considered and adaptation measures are in the detailed design, LXRA requires its contractors to undertake and implement a climate change risk assessment in accordance with Criteria Cli-1 and Cli-2 as defined by the ISCA IS rating tool. This is discussed further in Chapter 10 *Sustainability and climate change*.

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3.1 Introduction

This chapter provides an overview of the key findings of the EES.

The primary focus of the EES is to assess the potential for the projects to impact regional groundwater movements, and the effect this could have on the internationally-important Edithvale-Seaford Wetlands. It also assess how the trenches could expose existing contamination and potential acid sulfate soils, and possibly affect human health, recreation and ecosystems.

This chapter also includes references to the Environmental Performance Requirements (EPRs) relevant to each key finding. As set out in Chapter 1 *Introduction*, the EPRs define the environmental outcomes that must be achieved during design, construction and operation of the Edithvale and Bonbeach level crossing removal projects, regardless of the detailed design solutions adopted. They may also represent the measures developed in this EES to avoid, reduce or manage potential environmental impacts so that the key findings presented here are a realistic reflection of the likely environmental performance of the projects. The full list of EPRs is provided in Chapter 9 *Environmental Management Framework*.

3.1.1 Specialist investigations

Fourteen specialist investigations have been undertaken to identify and assess the potential environmental effects associated with realising the critical benefits of the projects. Three of these studies focus on issues which were identified by preliminary investigations and subsequently considered by the Minister for Planning to be potentially significant enough to require an EES:

- potential short and long-term effects on the regional groundwater regime
- potential short and long-term effects on the ecological character of the Edithvale-Seaford Wetlands and groundwater dependent ecosystems
- potential activation of coastal acid sulfate soils and subsequent groundwater use.

The remaining 11 investigations focus on issues that are common to all construction projects. These issues need to be understood in a local context to ensure that the management of these potential effects is appropriate for the site conditions and local community. All 14 investigations focus on the potential effects of the proposed rail trenches described in Chapter 2 *Rationale and project descriptions*.

The specialist investigations are included as appendices to this EES.

3.1.2 The structure of this chapter

In this chapter:

- Section 3.2 presents a summary of the key assets, values and uses within the Edithvale and Bonbeach areas.
- Section 3.3 summarises the key findings of Chapter 5 *Modelling the water environment*, as understanding the potential changes to the groundwater regime is key to identifying and assessing the potential impacts to the other matters identified by the Minister for Planning in the Scoping Requirements for the EES.
- Section 3.4 summarises the key findings of Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems*.
- Section 3.5 summarises the key findings of Chapter 7 *Acid sulfate soils and contamination*.
- Section 3.6 summarises the key findings of Chapter 8 *Potential local impacts at Edithvale and Bonbeach*.
- Section 3.7 summarises the key findings in the context of the EES Scoping Requirements and draft evaluation objectives.

Sections 3.3, 3.4 and 3.5 also outline how the EES responds to the draft evaluation objectives set out in the Scoping Requirements for the EES.

3.2 Key assets, values and uses

The Edithvale and Bonbeach areas are primarily residential, with increasing population densities and a population that is getting younger – attracted to the area in part due to the recreational lifestyle it caters for and, most notably, the Port Phillip Bay foreshore.

Inland, both the Edithvale-Seaford Wetlands and the Wannarkladdin Wetlands provide key environmental and social values for the area. The ecological value of the Edithvale-Seaford Wetlands is internationally recognised for providing a habitat for migratory species, while the Wannarkladdin Wetlands are more accessible for the public.

The Edithvale and Bonbeach areas contain a high number of both active and passive recreation reserves, including:

- the foreshore
- golf courses
- Edithvale Recreation Reserve
- Bicentennial Park
- Bonbeach Sports Reserve
- Patterson River.

The open spaces provide recreation opportunities for local residents and residents of the surrounding areas, and include sports fields, playgrounds, and cycling and walking trails. A number of recreational facilities and residences in the area have registered groundwater bores typically used for irrigation and domestic purposes. The Edithvale and Bonbeach areas also contain a number of schools and aged care facilities. Surf Life Saving Clubs at both Edithvale and Bonbeach are important community assets.

The area is served by the Frankston rail corridor, with stations at Edithvale and Bonbeach. The road network predominantly comprises local streets serving residential areas. However, both the Nepean Highway and Edithvale Road serve important regional arterial functions. Edithvale Road connects the area to the Mornington Peninsula Freeway (M11) and to Melbourne's eastern suburbs via Springvale Road, Eastlink and Westall Road. Both railway stations are adjacent to commercial precincts on the western side of Nepean Highway, which are largely dependent on the residents who live east of, and whose access to the shops is restricted by, the highway and rail corridor.

3.3 Potential impacts to regional groundwater

The proposed rail trenches would extend into the groundwater below the surface. The piled walls of the trenches described in Chapter 2 *Rationale and project descriptions* would create an obstruction to the flow of groundwater, which flows in a westerly direction towards the coast at Edithvale and in a more south-westerly direction towards the coast and Patterson River at Bonbeach.

The obstruction created by the walls of the trench would require groundwater to travel around the trench, which would have an effect similar to a dam in a river, with groundwater mounding up-gradient (that is, rising water table 'upstream') and groundwater drawdown down-gradient (lowering of the water table 'downstream') of the trenches.

The depth to the water table across the region currently varies greatly, depending on the elevation of the ground surface, the time of year, and longer term climatic trends. For example, the water table is deeper during summer months, and extended dry periods such as droughts.

The natural variability, and the mounding and drawdown effects for an extended wet period when the groundwater is shallower and closer to the surface are shown conceptually in Figure 3.1. Figure 3.2 depict drought conditions when the water table is deeper.

Figure 3.1 Schematic of groundwater level with and without proposed trenches – extended wet period

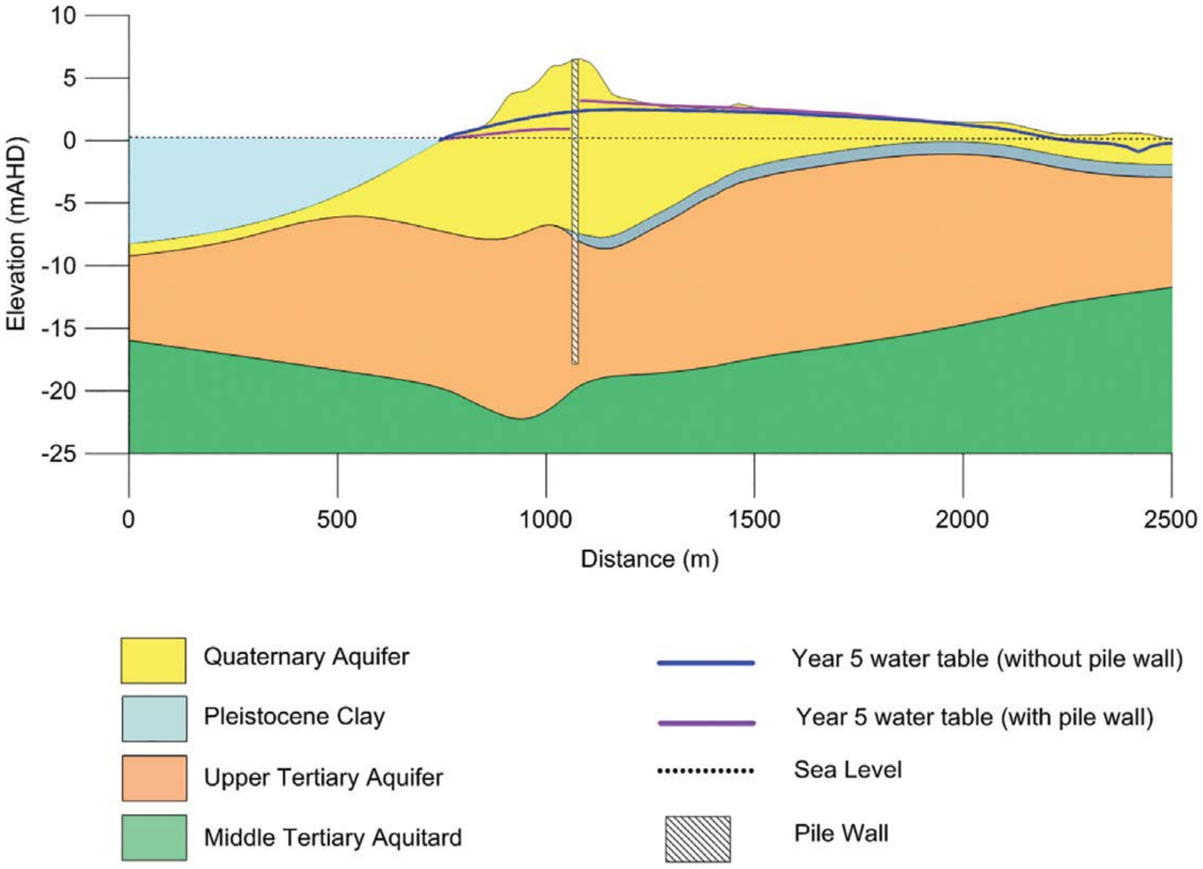
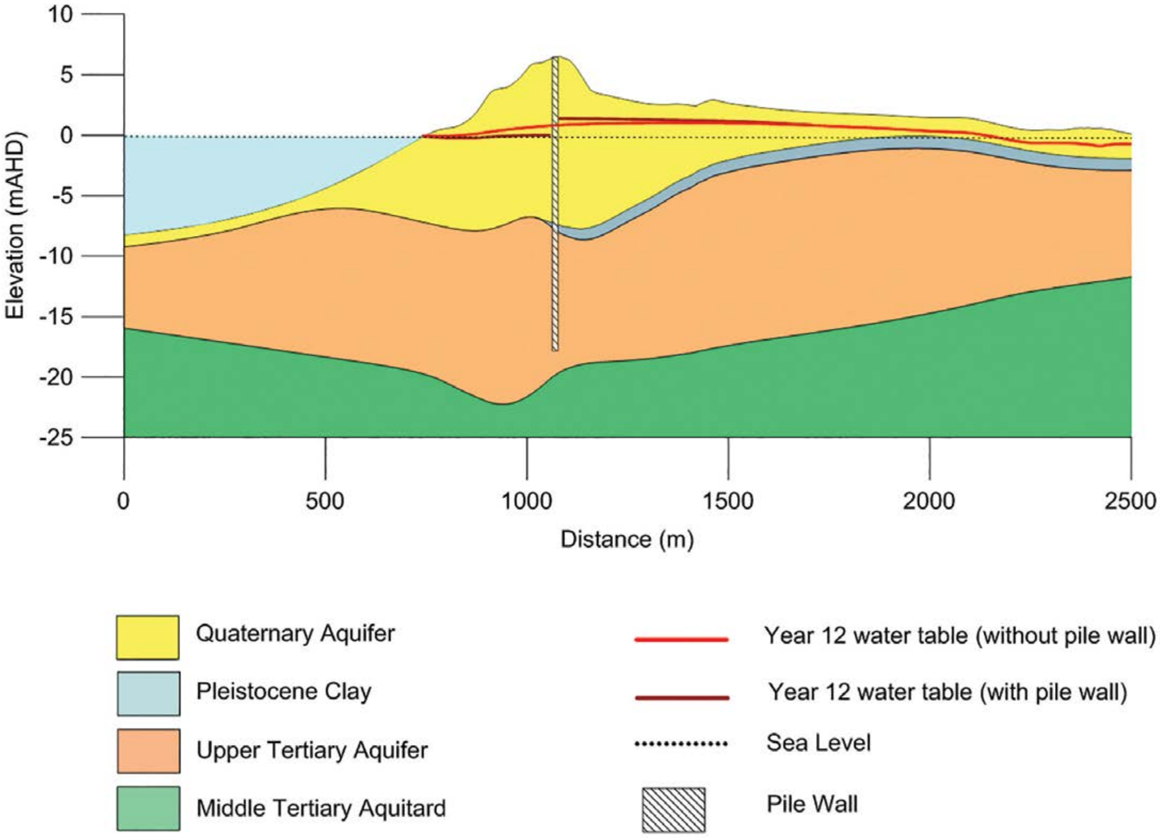


Figure 3.2 Schematic of groundwater levels with and without proposed trenches – drought conditions

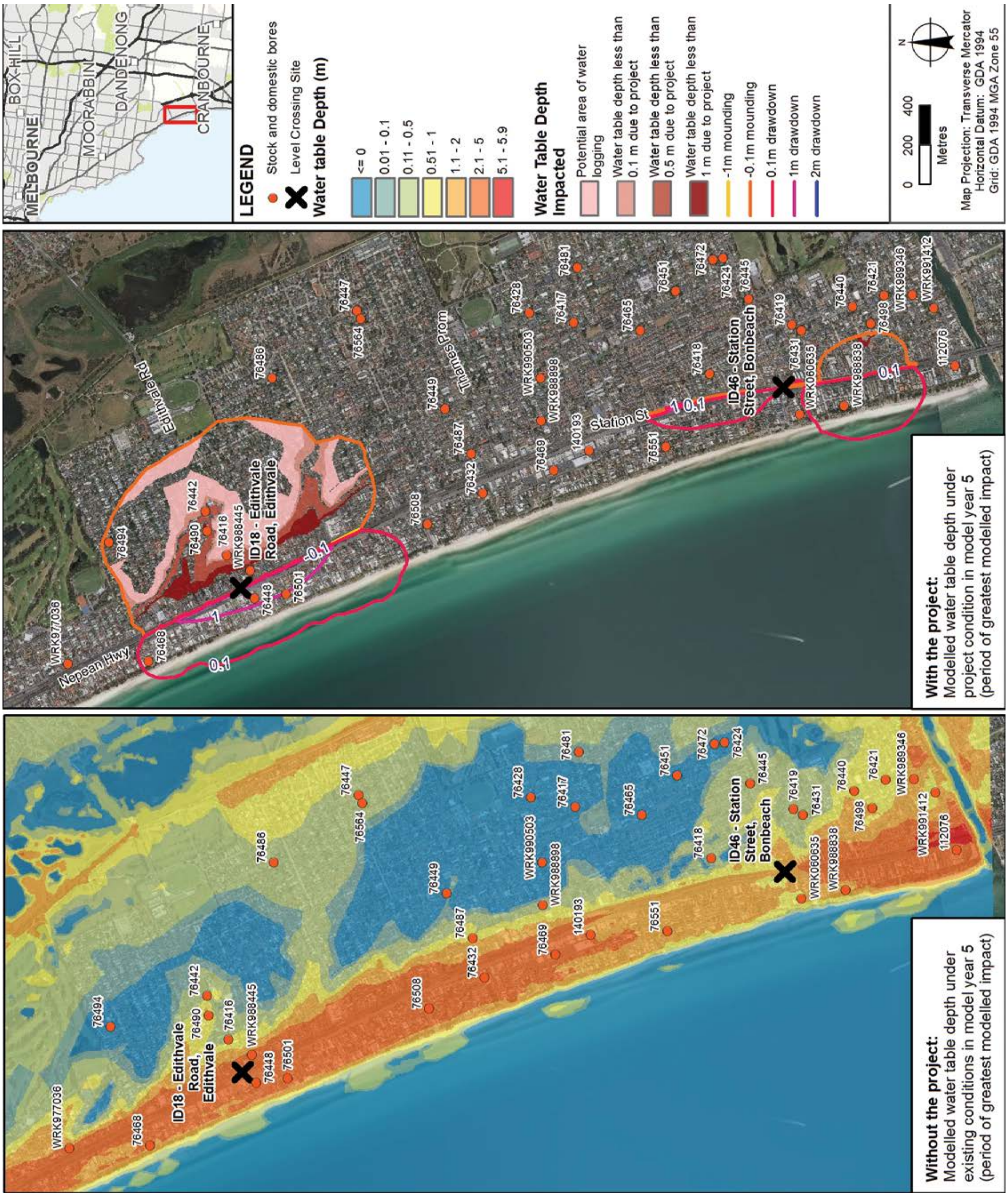


To understand the effect of the trenches on groundwater levels, a regional groundwater model was constructed, using 20 years of data collected from an existing set of groundwater monitoring bores through the region, as well as data collected from over 120 bores installed more recently along the Frankston rail corridor and within the Edithvale Wetland. The model, once calibrated (running and correcting parameters within the model to align predicted outputs against observed data), was run nearly 200 times to predict the magnitude and extent of changes in groundwater levels. A peer review of the groundwater model was also conducted.

The extent of groundwater mounding predicted from the initial modelling is shown in Figure 3.3. This shows the modelled worst case scenario, derived from a range of climatic data that spans drought periods and extended wet periods. The changes to groundwater shown in this figure represent a particularly wet period, when there is more groundwater in the soils, it is shallower, and hence a larger area of change is predicted.

The most conservative modelled impacts, shown in Figure 3.3, have informed the impact assessments. On this basis, in drier periods the potential effects can be expected to be less, relative to those discussed within this EES.

Figure 3.3 Potential water logging at Edithvale and Bonbeach predicted by the initial modelling



3.3.1 Edithvale

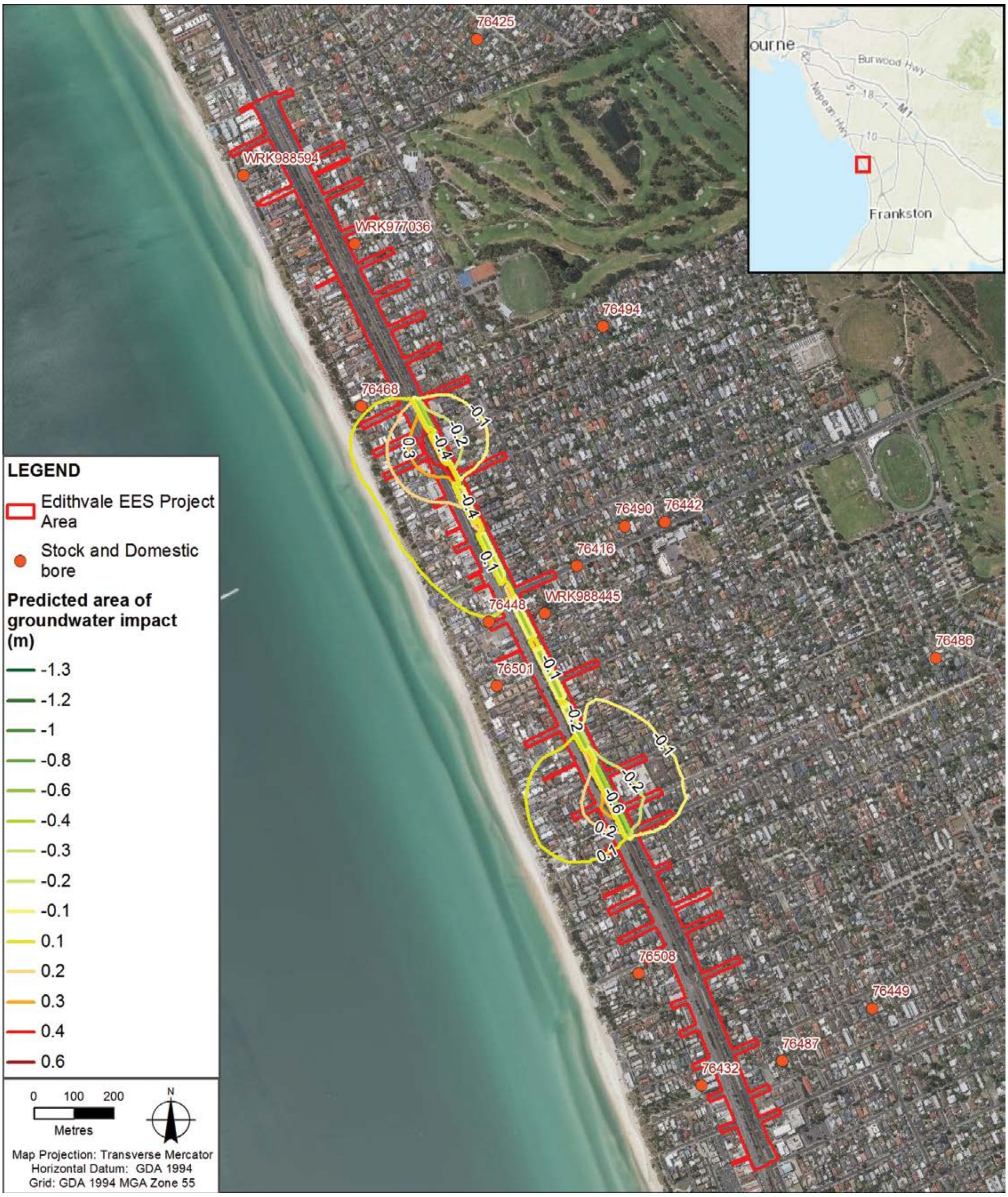
An initial assessment was undertaken which included modelling of project operation based on the pile wall configuration described in Chapter 2 *Rationale and project descriptions.* The groundwater model prepared for the EES predicted that the trench proposed at Edithvale would result in groundwater mounding on the inland side that could potentially increase the frequency of water logging that already occurs on occasion in the Edithvale area, as shown in Figure 3.3.

This is because of the naturally very shallow water table and because groundwater flows at right angles to the proposed trench towards the coast. This direction of groundwater flow means that the damming effect of the trench is at its most significant. If the groundwater flow was less perpendicular to the trench, the mounding effect would be less because the trench would present less of an obstacle to groundwater flow.

In response to the risk of water logging, and other potential issues including activation of acid sulfate soils and a potential increase in the salinity of groundwater, a mitigated assessment was undertaken. This involved amending the project design to include an engineering solution that would enable groundwater to flow around the trench and reduce the potential mounding to within natural variability. The engineering solution was then tested using the groundwater model to confirm it would be effective to reduce groundwater mounding so that it would not result in additional water logging.

Based on the mitigated assessment, the predicted groundwater level changes were less, compared with the initial assessment at Edithvale. The model predicts that with the engineering solution to manage groundwater flows in place, levels may rise up to 0.2 metres within 50 metres of the trench walls on the up-gradient or inland side, with levels reducing on the down-gradient (coastal) side by 0.3 metres within 50 metres of the trench. Contours representing the extent of mounding and drawdown after the engineering solution has been implemented are shown in Figure 3.4.

Figure 3.4 Modelled changes to groundwater levels at Edithvale based on the mitigated assessment



The groundwater changes based on the implementation of the engineering solution are within the range of natural variability and would not affect existing water logging.

Based on the mitigated assessment, the key findings of the model also indicate that:

- Mounding is predicted to reduce to less than 0.1 metres within 150 metres of the trench, and therefore would return to background levels at around 1,000 metres of the Edithvale-Seaford Wetlands. On this basis, the assessment presented in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* and Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems* concludes that it would be almost impossible for the proposed rail trenches to affect regional groundwater to the extent that the ecological character of the Edithvale-Seaford Wetlands would be affected.
- Drawdown on the coastal side of the trench is predicted to reduce to less than 0.1 metres also within 150 metres of the trench. On this basis, the risk to beneficial uses of groundwater, including groundwater bore users and vegetation, is considered to be negligible.

3.3.2 Bonbeach

The initial assessment included groundwater modelling at Bonbeach, based on the piled walls of the trench described in Chapter 2 *Rationale and project descriptions.*

Groundwater is naturally deeper at Bonbeach than it is at Edithvale, resulting in lower potential for interference from the trench. The direction of groundwater flow is also different at Bonbeach, flowing in a south-westerly direction, meaning that the north-south oriented trench presents less of an obstacle to groundwater flow, and subsequently results in less mounding than if the trench was at right angles to groundwater flow as at Edithvale.

The groundwater mounding and drawdown predicted through the initial assessment at Bonbeach was significantly less in terms of magnitude and extent of potential impacts, when compared to the initial modelling predictions for Edithvale. Contours representing the extent of mounding and drawdown are shown in Figure 3.3. This demonstrates that the project would not result in any water logging of the Bonbeach area.

The construction of the proposed trench at Bonbeach is predicted to result in groundwater mounding on the inland side of the trench and drawdown on the coastal side of the trench. Groundwater mounding of up to 0.4 metres within 50 metres of the rail trench is predicted, along with groundwater drawdown of up to 0.7 metres within 50 metres of the rail trench. The mounding would not result in water logging and would not have any significant impact. Minor implications associated with drawdown are as follows:

- potential activation of small, localised areas of acid sulfate soils (discussed in Section 3.5, and Chapter 7 *Acid sulfate soils and contamination*)
- reduced availability of water for a small number of domestic groundwater users who have groundwater bores installed between the rail corridor and Port Phillip Bay.

A mitigated assessment was not undertaken for Bonbeach, since the risks identified through the initial assessment were considered sufficiently low, such that further mitigation beyond the modelled project design would not be required. The pile wall configuration proposed includes measures that minimise potential impacts to groundwater, including stepped depths of impermeable piles. The design of the Bonbeach project would still be required to meet the requirements of the EPRs. Refer to Chapter 2 *Rationale and project descriptions* for further information.

3.3.3 Meeting the evaluation objectives

The impact assessment focused on project-induced groundwater level impacts resulting from groundwater level drawdown and mounding as a result of the projects. The potential impacts associated with this change that were considered were:

- short-term construction impacts
- interference with local groundwater users
- interaction with existing contaminated or potentially contaminated groundwater
- changes to groundwater levels in the vicinity of groundwater dependent ecosystems (particularly the Edithvale-Seaford Wetlands)
- potential for water logging
- potential for subsidence impacts
- potential for acid sulfate soil activation
- potential for saline intrusion.

Overall, the projects would meet the evaluation objective to minimise effects on the regional groundwater regime. The design assessed within this EES minimises potential effects on regional groundwater and associated beneficial uses, and critically, does not result in changes to the hydrology at the Edithvale-Seaford Wetlands.

EES evaluation objective

To prevent effects on the regional groundwater regime and quality, particularly as they might impact on the hydrology of the Edithvale-Seaford Wetlands and elsewhere on other beneficial uses.

3.4 Edithvale-Seaford Wetlands and groundwater dependent ecosystems

The Edithvale-Seaford Wetlands, including its native vegetation, habitat and wetland species, would not be impacted by the proposed projects.

The wetlands are listed under the Ramsar Convention on Wetlands of International Importance, recognised globally for their important habitat for migratory species. They are protected by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act), and are one of a number of Groundwater Dependent Ecosystems (GDEs) in the region which have been considered in this assessment.

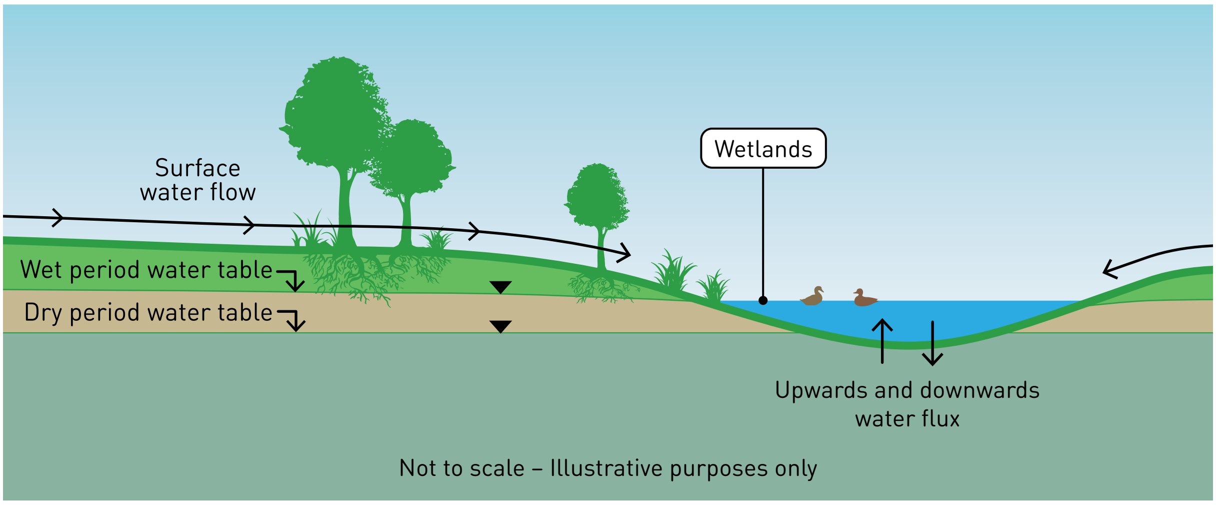
For a wetland to be listed under the Ramsar Convention, it must satisfy one or more of the criteria for identifying wetlands of international importance. The assessment has considered the capacity of the Edithvale-Seaford Wetlands to continue to meet the Ramsar listing criteria.

A GDE is defined as:

> 'those ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain the communities of plants and animals and ecological processes they support, and ecosystem services they provide'.

A conceptual diagram showing the relationship between GDEs and the water cycle is shown in Figure 3.5.

Figure 3.5 Groundwater dependent ecosystems


Surface water flow
Wetlands
Wet period water table
Dry period water table
Upwards and downwards water flux
Not to scale – Illustrative purposes only

The Edithvale-Seaford Wetlands are regarded as a GDE as they are considered to rely, at least in part, on groundwater to sustain its flora, fauna and overall ecological character. A summary of the assessment undertaken into the Edithvale-Seaford Wetlands, and a discussion of other potentially affected GDEs throughout the area, are presented below.

3.4.1 Edithvale-Seaford Wetlands

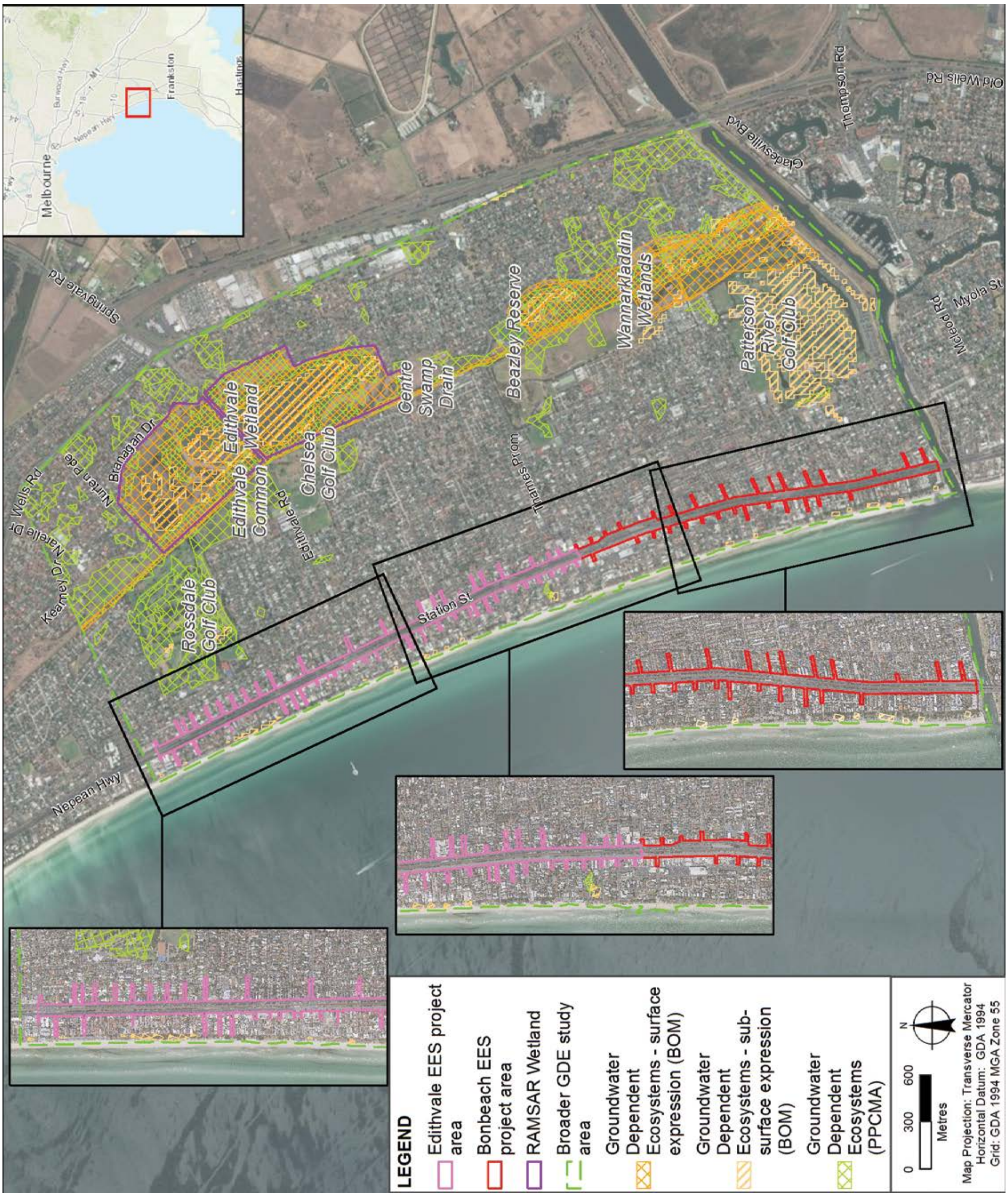
The Edithvale-Seaford Wetlands represent the remnants of the former Carrum Carrum Swamp, a shallow freshwater swamp that was largely drained in the late nineteenth century to reclaim land for agriculture and housing. In 1974 the area was protected by the then Dandenong Valley Authority due to the potential for the wetlands' capacity to process floodwaters in the area.

They comprise two separate components, the Edithvale Wetland and the Seaford Wetland. The Seaford Wetland is over five kilometres from the Edithvale Wetland, and is separated from Edithvale Wetland and both project sites by Patterson River and Patterson Lakes. These features provide a hydrogeological barrier such that any changes to the regional groundwater regime due to the projects could not affect the Seaford Wetland. The Seaford Wetland is therefore not considered further.

Given the distances between the Edithvale Wetland and the project sites (1.3 kilometres from the existing Edithvale Road level crossing and two kilometres from Bonbeach), the works would not directly impact the wetlands through, for example, loss of vegetation or disturbance to bird species. Furthermore, the groundwater modelling predicts that the effect of the trenches on regional groundwater would return to background levels at least 1,000 metres away from the Edithvale Wetland, such that the hydrological regime and ecological character of the wetlands would not be affected, and would therefore continue to meet the applicable Ramsar listing criteria.

More information regarding the Edithvale Wetland is provided in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* and EES Attachment III *Matters of national environmental significance*.

Figure 3.6 Location of the Edithvale-Seaford Wetlands and other GDEs relative to the two project areas



3.4.2 Groundwater dependent ecosystems

There are several GDEs within the Edithvale and Bonbeach region in addition to the Edithvale Wetland including the Wannarkladdin Wetlands, Edithvale Common, golf courses and the Aspendale to Carrum Foreshore Reserve. These are shown in Figure 3.6 relative to the two project areas.

The risk of the projects impacting the Wannarkladdin Wetlands is negligible as the wetlands do not fall within the zone of predicted changes to groundwater. Vegetation within other GDEs inland of the rail corridor are not anticipated to be affected because the modelled changes to groundwater levels are not significant in those areas, if present at all.

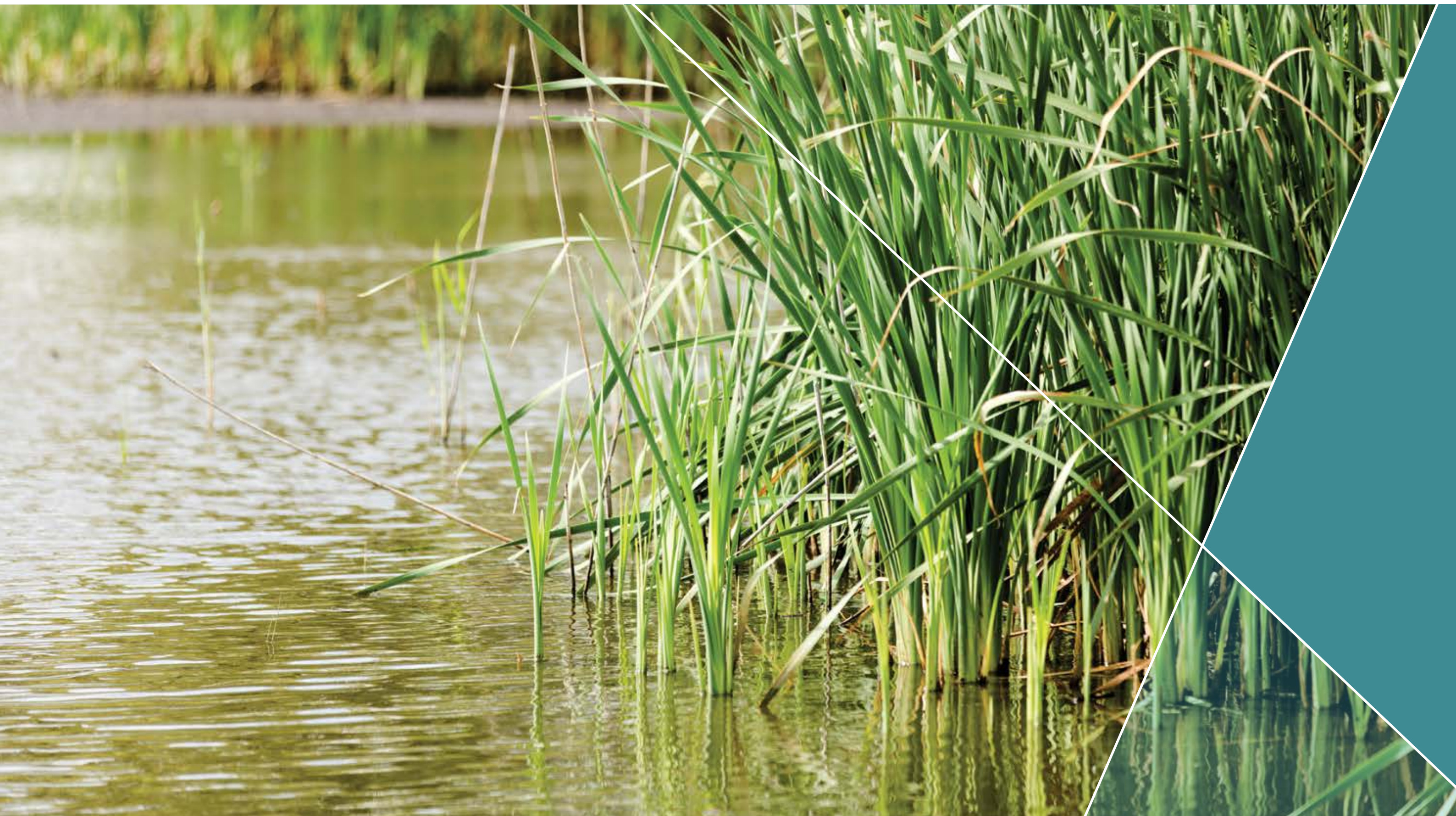
On the coastal side of the rail corridor, the predicted lowering of the water table due to the Bonbeach project has the potential to affect up to 2.1 hectares of foreshore vegetation within the Aspendale to Carrum Foreshore Reserve. The vegetation within the Reserve is of moderate to high quality and has been modified over time but provides a largely continuous habitat corridor, erosion protection and amenity value.

The foreshore vegetation could be impacted by acidification of groundwater or by the loss of access to groundwater. The assessments undertaken for the EES identify a negligible risk of this impact occurring at Edithvale and a minor risk at Bonbeach. To manage the low overall risk of this impact occurring, the EPRs provide for the monitoring of groundwater levels and quality, and the preparation of mitigation measures to be implemented if an impact were to occur.

More information regarding the GDEs is provided in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems*.

3.4.3 Native vegetation

Native vegetation is present within the rail corridor and would be removed to enable construction of the proposed rail trenches. Conservatively assuming that both project areas would be cleared of all vegetation, the area of affected native vegetation would total 2.2 hectares. This would be substantially minimised in finalising project designs and construction methodologies, clearing only what would be necessary, and offsetting the impacted vegetation in accordance with Victorian Government policy. Affected vegetation does not provide habitat for threatened species.



3.4.4 Meeting the evaluation objective

Overall, the project would meet the evaluation objective of avoiding, minimising and/or offsetting adverse ecological effects through avoiding impacts to the Ramsar listed Edithvale-Seaford Wetlands and the Wannarkladdin Wetlands, as well as offsetting directly impacted vegetation and committing to mitigate any impacts to the foreshore vegetation that are attributed to the projects. No listed threatened species are likely to be impacted by the projects.

EES evaluation objective

To avoid, minimise and/or offset adverse effects on native vegetation, listed threatened species and ecological communities, listed migratory species, the Ramsar listed Edithvale-Seaford Wetlands, other protected flora and fauna and groundwater dependent ecosystems.

3.5 Acid sulfate soils and contamination

A comprehensive soil testing program has been undertaken along both the Edithvale and Bonbeach project areas, with bores tested for both soil and groundwater quality, as discussed below.

3.5.1 Excavation techniques

The excavation and management of potential acid sulfate soils and contaminated soils can be managed to avoid impacts on human health and the environment. This is because excavation of such soils would take place after the continuous impermeable pile walls at either side of the proposed trenches are constructed. This would prevent groundwater entering the trenches during construction and any water or soil migrating away from the trenches. Potential acid sulfate soils would be managed in accordance with the Victorian Government's *Best practice guidelines for assessing and managing coastal acid sulfate soils 2010,* and it is proposed to remove any potentially acidic soil from the project areas immediately following excavation. Testing of soil would be undertaken prior to excavation in accordance with EPA Victoria guidelines to ensure that any contaminated soil is identified and managed appropriately.

3.5.2 Acid sulfate soils

Acid sulfate soils occur naturally in the environment and contain minerals such as iron sulfide. When exposed to air they can react with oxygen and may produce acidic run-off and odours, potentially affecting beneficial uses. In a coastal context, they are known as Coastal Acid Sulfate Soils (CASS).

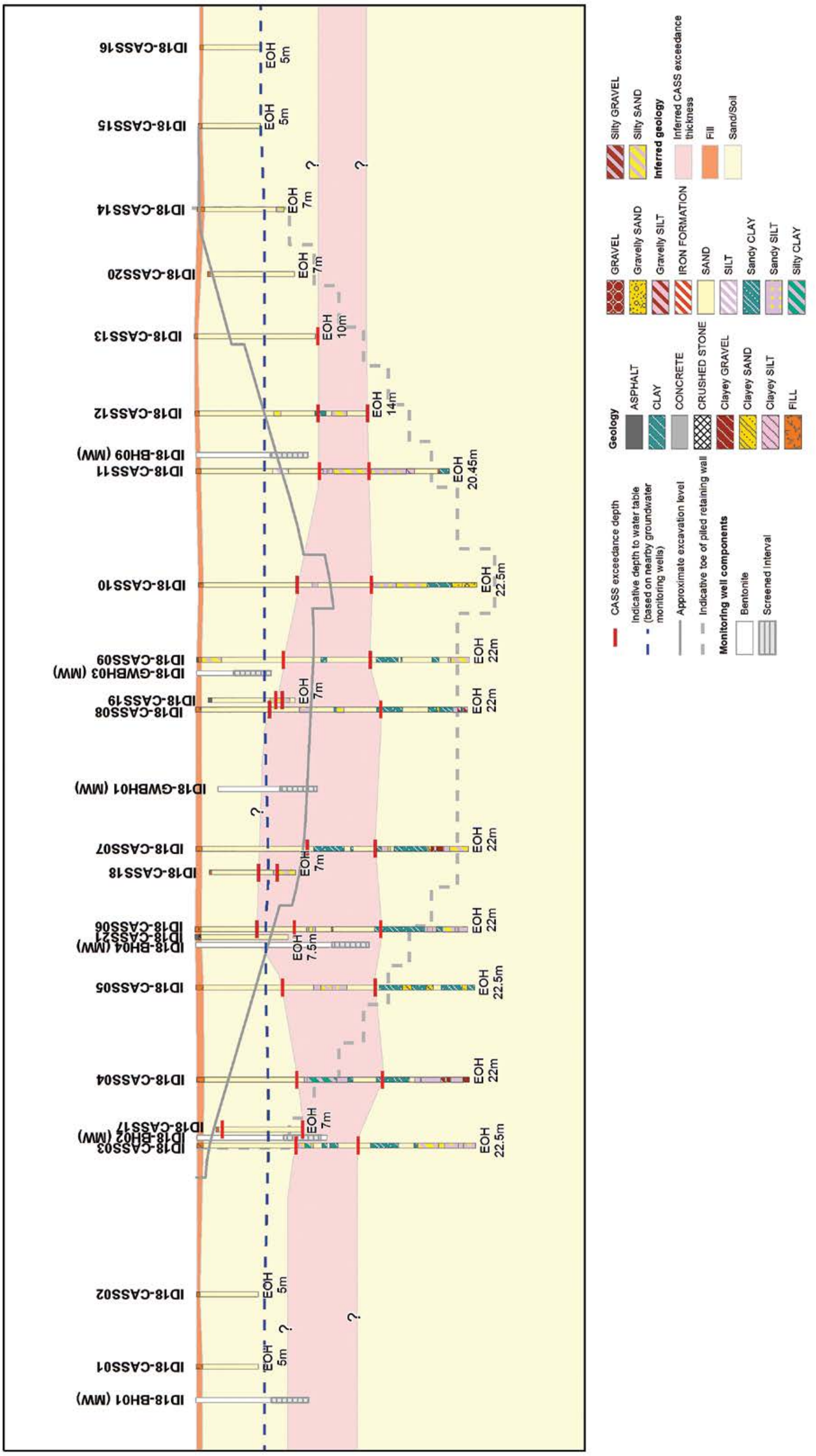
Within the project areas, potential acid sulfate soils are present between 4 to 15 metres below ground level at Edithvale and 3.5 to 16 metres below ground level at Bonbeach. These soils do not occur as a solid and regular band, but rather as discontinuous and irregular patches and are predicted to occur within the pink band shown in Figure 3.7 (at Edithvale) and Figure 3.8 (at Bonbeach).

CASS are relevant in two ways:

- They are likely to be present within soils excavated for piling and the trenches.
- Drawdown of groundwater has the potential to expose buried CASS to air.

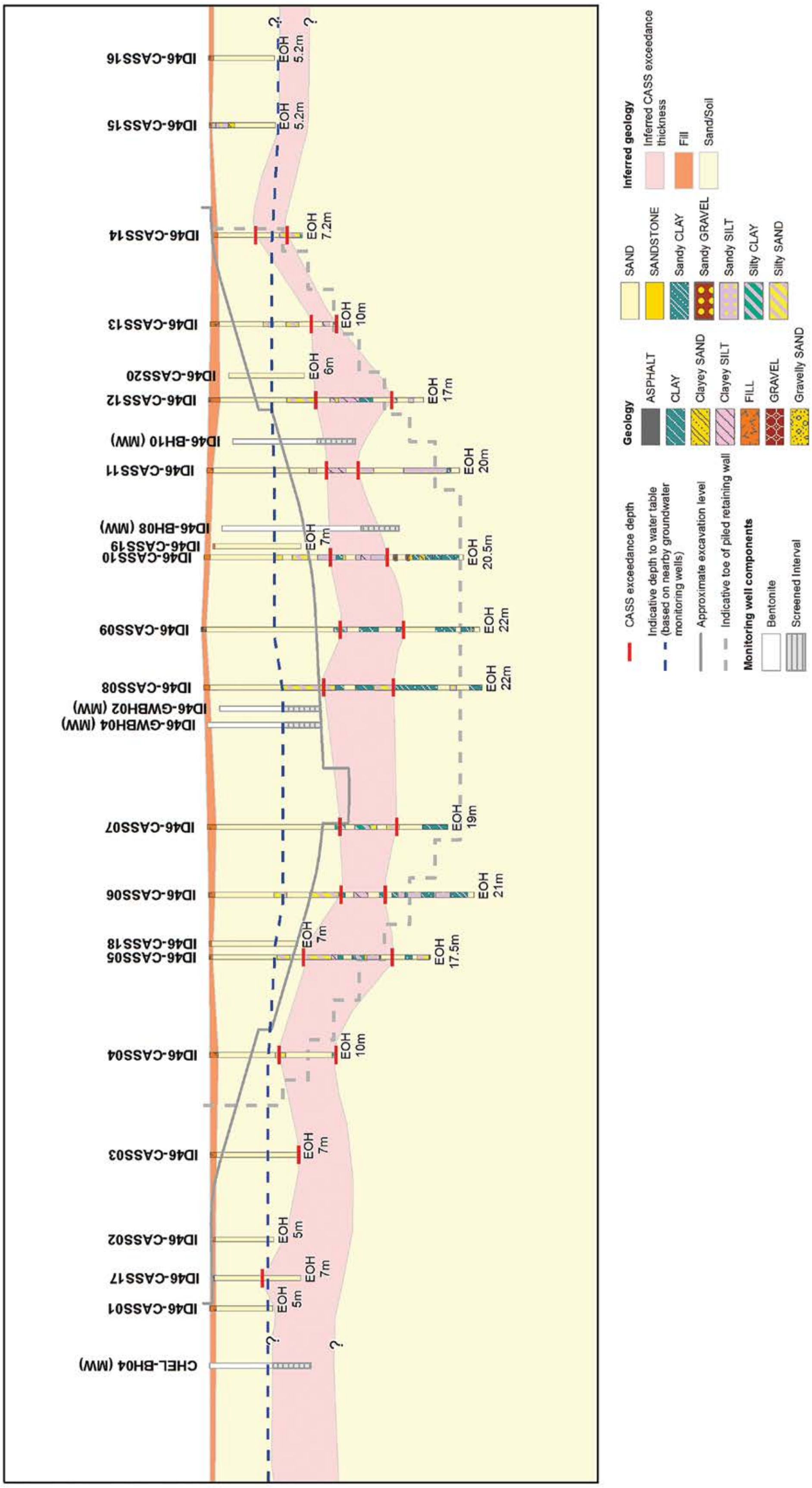
These are discussed in the following pages.

Figure 3.7 Conceptual and indicative depth of CASS at Edithvale



Graphics showing inferred fill/CASS exceedance/sand/soil are indicative only

Figure 3.8 Conceptual and indicative depth of CASS at Bonbeach



Graphics showing inferred fill/CASS exceedance/sand/soil are indicative only

Excavation of CASS

The key finding regarding CASS is that they would almost certainly be encountered during excavations. Modelling indicates that a total volume of 51,870 cubic metres of CASS from both projects would require management in accordance with well established guidelines and practices developed by the EPA Victoria and the Victorian Government, including:

- EPA Victoria Publication 655.1 *Information Bulletin: Acid Sulfate Soil and Rock 2009*
- *Industrial Waste Management Policy (Waste Acid Sulfate Soils) 1999* (IWMP)
- *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils 2010.*

These guidelines outline measures for handling CASS to minimise potential impacts, and require that disposal of CASS occurs only at a facility licenced to receive it.

Drawdown of groundwater potentially activating CASS

As identified in Section 3.3, drawdown of groundwater is modelled to occur at Bonbeach. With groundwater predicted to drawdown to a depth that is approximately level to the top of the CASS band in two limited areas, it is considered that any potential acid sulfate soils in these two limited areas would be activated. However, the areas of potential acid sulfate soils are relatively small and may already have been activated by natural lowering of the water table. This is supported by the groundwater results for the shallow aquifer which shows the presence of existing acidity. Monitoring of groundwater quality would be undertaken in accordance with the EPRs to ensure any potential acidification of groundwater likely to impact beneficial uses would be prevented.

3.5.3 Contamination

Based on the investigations undertaken, it is expected that some of the soil to be excavated would be contaminated through existing and historical land uses, such as the use of fill material in the rail corridor, and adjacent land uses such as a fire station, service stations and drycleaners. Contaminants such as metals, hydrocarbons, asbestos and other industrial chemicals are considered likely to be present in some of the soil excavated.

While there are no sites along the project areas which the EPA Victoria has registered as particularly contaminated, a number of environmental audits have been undertaken within 500 metres of both project areas which identified contaminants such as metals, hydrocarbons and elevated nutrients at the relevant sites.

Construction

When soils are excavated, they are categorised and must be managed in accordance with EPA Victoria policy. Categories are fill (or clean soil), or Category A, B or C, with Category A representing the most contaminated material.

Based on the sampling undertaken to date, approximately 40,000 cubic metres of excavated soils across both projects would be classified as Category C material, requiring disposal at a licenced facility. Approximately 100 cubic metres may be classified as Category A or B. Appropriately licenced sites with sufficient capacity are available, and one or more suitable licenced facilities in the region would be determined closer to the construction date, subject to other concurrent projects. All disposal sites are accessible from the project sites via Station Street and arterial roads that are designated for the movement of heavy vehicles.

The assessments undertaken during the preparation of the EES identified that the risk to human health and the environment, from odours and in regard to excavating, transporting and disposing of contaminated material in accordance with EPA Victoria's policies and requirements, is negligible. A more detailed sampling program would be undertaken prior to the commencement of excavation to assess the quality of soils in accordance with the EPA's *Industrial Waste Resource Guidelines*. With no re-use opportunities or room for stockpiling excavated soils within the project areas, all excavated soils would be transported directly offsite.

Operation

Drawdown and mounding of groundwater as a result of the proposed trenches has the potential to locally change the direction of groundwater flows which could also result in the movement of any existing contaminant plumes. While modelling of the proposed project design at Bonbeach indicates the potential for this impact to occur, further detailed design development in accordance with the EPRs developed for the projects would ensure that water quality is not impacted to the extent that beneficial uses of groundwater are precluded.

The project would not result in any significant additional contamination of soil or groundwater. Acidification of small pockets of potential acid sulfate soils may occur at Bonbeach as a result of drawdown of groundwater, however, this potential impact would be monitored and managed if required. Minor changes to the direction of existing groundwater plumes is possible, however, no plumes of contaminated groundwater have been identified in the studies undertaken for the EES.

3.5.4 Meeting the evaluation objective

Overall, the projects would meet the evaluation objective to prevent adverse environmental or health effects from disturbing, storing or influencing the movement of contaminated or acid-forming material, and ensuring designs protect beneficial uses. Excavation of material that is likely to be contaminated would be unavoidable, however, implementation of well-defined and established practices to manage environmental and human health risks would be implemented.

EES evaluation objective

To prevent adverse environmental or health effects from disturbing, storing or influencing the movement/transport of contaminated or acid-forming material.

3.6 Informing the Environmental Management Framework

This section summarises the potential environmental effects during construction and operation at both project sites that may require management through an Environmental Management Framework, as required by Section 3.5 of the Scoping Requirements.

The potential impacts to the community during the construction of the two projects are typical of any construction project, in terms of the following issues:

- **Traffic** – Traffic management and ensuring safe movement of vehicles, pedestrians and cyclists around the construction activity, including the safe and efficient movement of construction traffic through the community.
- **Access** – Pedestrian, cyclist and vehicle access across the rail corridor is a particular consideration for the community and businesses alike and would be impacted at times, most notably during the major rail occupation period of major construction activity. Alternative routes would be available at all times.
- **Noise** – Construction noise would be an issue and managed in accordance with EPA Victoria requirements during the construction activity scheduled to occur prior to and following the main occupation. EPA Victoria Publication 1254 *Noise Control Guidelines 2008* provides guidance to contractors which would be incorporated into the day-to-day activities. During the main rail occupation, works would occur 24 hours a day to minimise the duration of disruption to rail users and the local communities. As a result, the most affected residences may be eligible for relocation during the works, subject to criteria that would be developed in conjunction with the detailed design and construction methodology.
- **Air quality** – Air quality may be affected by vehicle emissions and dust, both of which would be managed in accordance with EPA Victoria Publication 480 *Best Practice Environmental Management: Environmental guidelines for major construction sites 1996*.

These issues, alongside the visual appearance of construction activity, can be considered cumulatively as an impact to amenity for the local communities and businesses, and are necessary to remove the dangerous and congested level crossings. The EPRs for the projects require comprehensive environmental and traffic management plans to be implemented to ensure legislative and policy requirements are met. An extensive program of community and stakeholder consultation would also be undertaken prior to and during construction to ensure that the community, particularly residents and businesses that may potentially be directly affected, are aware of upcoming works and are able to plan their activities.

The local community and commuters reliant on the Frankston rail line would benefit from the removal of the two level crossings. While there are broad-reaching benefits for the community, there would be localised impacts associated with the trenches for some adjacent residents.

During operation, changes are both positive and negative, and relate to visual amenity of the area associated with the upgraded station and railway infrastructure, loss of existing vegetation as well as planting of new vegetation and construction of new infrastructure, particularly the safety barriers and footbridges and noise, as follows:

- **Noise** – Noise modelling confirms that the projects would not exceed the investigation thresholds in the Victorian Government's *Passenger Rail Infrastructure Noise Policy 20013*. This means that the noise from trains using the new infrastructure is within the limits set under the policy and does not require mitigation or management.
- **Visual amenity** – The areas surrounding the projects are highly valued for their coastal setting. The projects would change the visual appearance of the transport corridor through Edithvale and Bonbeach by replacing the existing at-grade rail infrastructure with a modern station building and precinct, car parking on deck, footbridges, safety barriers along the trench and a substation at Edithvale.

3.7 Summary of key findings

The projects would remove two dangerous and congested level crossings, and contribute to significant improvements in the capacity, efficiency and reliability of the Frankston rail line, and create safer and more vibrant precincts for the two suburbs.

Like all infrastructure projects, their construction and operation would change the local setting and potentially affect the local environment, particularly during construction. The construction activity would be disruptive, particularly to those who live adjacent to the works. However, the disruption would be temporary and LXRA would work closely with those affected to ensure a high level of communication is maintained throughout the construction period, which would ultimately deliver a high quality urban outcome that creates a much safer environment for residents of, and visitors to, Edithvale and Bonbeach.

Once the railway is in trenches, potential effects of the projects would be associated with changes to the shallow groundwater levels through both Edithvale and Bonbeach. The detailed designs of the projects would be developed in accordance with the EPRs set out in Chapter 9 *Environmental Management Framework*, which would ensure that the potential effects are effectively managed and mitigated such that the evaluation objectives are met. Critically, it is considered almost impossible for the projects to affect the Edithvale-Seaford Wetlands as groundwater changes are not predicted to occur within 1,000 metres of the wetlands.

The initial groundwater model prepared for the EES predicted that the trench proposed at Edithvale would result in groundwater mounding on the inland side that could potentially increase the frequency of water logging that already occurs on occasion in the Edithvale area. The same impact was not identified at Bonbeach.

In response to the risk of water logging, activation of acid sulfate soils and a potential increase in the salinity of groundwater, an engineering solution was developed to enable groundwater to flow around the trench structure at Edithvale and reduce the potential mounding to within natural variability. The engineering solution was then tested using the groundwater model to confirm it would be effective to reduce groundwater mounding so that it would not result in additional water logging.

Groundwater drawdown between the trenches and the coast may affect a small area of coastal vegetation and acid sulfate soils, but through implementing the EPRs, beneficial uses of groundwater would not be impacted. The assessment has not identified any potential impacts to human health or recreation.

Table 3.1 provides a summary of the key findings.

On balance and in considering these findings, LXRA considers that the three evaluation objectives established by the Scoping Requirements have been met.

Table 3.1 Summary of key findings

Topic	Key finding	Further information
Potential impacts to regional groundwater Section 3.3	The proposed trench at Edithvale has the potential to exacerbate existing water logging as a result of groundwater intersecting with the surface. The project would be designed to avoid this impact and ensure no significant impacts to the environment occur. An engineering solution has been developed and modelled using the independently peer reviewed groundwater model prepared for the EES to demonstrate this outcome is achievable. Groundwater flows in a different direction at Bonbeach compared to Edithvale and mounding is not predicted to cause waterlogging at this project.	Chapter 5 *Modelling the water environment* Technical Report A *Groundwater*
Edithvale Wetland Section 3.4.1	Given the distances between the Edithvale Wetland and the project sites (1.3 kilometres from the existing Edithvale Road level crossing and two kilometres from Bonbeach), the works would not directly impact the wetlands through, for example, loss of vegetation or disturbance to bird species. Furthermore, the groundwater modelling predicts that the effect of the trenches on regional groundwater would return to background levels at least one kilometre from the wetlands, such that the hydrological regime and ecological character of the wetlands would not be affected. The Edithvale-Seaford Wetlands would therefore continue to meet the applicable Ramsar listing criteria.	Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*
Groundwater dependent ecosystems Section 3.4.2	Terrestrial GDEs exist in a naturally variable environment in which water is accessed via the surface or groundwater. Both sources naturally fluctuate based on long-term climatic conditions and the prevailing weather and as such terrestrial GDEs must be adaptable and resilient to these variable conditions. Given the small change in groundwater predicted through the model it is likely changes to vegetation will be minor or negligible.	Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*
Native vegetation Section 3.4.3	Native vegetation is present within the rail corridor and would be removed to enable construction of the proposed rail trenches. Conservatively assuming that both project areas would be cleared of all vegetation, the area of affected native vegetation would total 2.2 hectares. This would be substantially minimised in finalising project designs and construction methodologies, clearing only what is necessary, and offsetting the impacted vegetation in accordance with Victorian Government policy.	Chapter 8 *Potential local impacts at Edithvale and Bonbeach* Technical Report D *Ecology: Project Areas*
Acid sulfate soils and contamination Section 3.5	The projects would prevent adverse environmental or health effects from disturbing, storing or influencing the movement of contaminated or acid-forming material, and be designed to protect beneficial uses. Excavation of material that is likely to be contaminated would be unavoidable, however implementation of well-defined and established practices to manage environmental and human health risks would be implemented.	Chapter 7 *Acid sulfate soils and contamination* Technical Report C *Acid Sulfate Soils and Contamination*

Topic	Key finding	Further information
Construction impacts Section 3.6	Construction would result in localised amenity impacts related to noise and transport network disruption, but can be managed effectively using well established practices. The potential impacts to the community during the construction of the two projects are typical of any construction project. Comprehensive environmental and traffic management plans would be implemented to ensure legislative and policy requirements are met, and an extensive program of community and stakeholder consultation would be undertaken prior to and during construction to ensure that the community, particularly residents and businesses that may potentially be directly affected, are aware of upcoming works and are able to plan their activities.	Chapter 8 *Potential local impacts at Edithvale and Bonbeach* Technical Reports E to N
Noise during operations Section 3.6	Noise modelling confirms that the projects would not exceed the investigation thresholds in the Passenger Rail Infrastructure Noise Policy.	Chapter 8 *Potential local impacts at Edithvale and Bonbeach* Technical Report H *Noise and Vibration*
Visual amenity Section 3.6	The areas surrounding the projects are highly valued for their coastal setting. The projects would change the visual appearance of the transport corridor through Edithvale and Bonbeach by replacing the existing at-grade rail infrastructure with a modern station building and precinct, car parking on deck, footbridges, safety barriers along the trench and a substation at Edithvale. Although vegetation would be lost, new landscaping would be established.	Chapter 8 *Potential local impacts at Edithvale and Bonbeach* Technical Report J *Landscape and Visual*

4 ASSESSMENT FRAMEWORK

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4.1 Introduction

This chapter describes how the EES for the Edithvale and Bonbeach level crossing removal projects has been prepared. It also describes how the environmental risks and potential impacts of the projects have been investigated and the development of the Environmental Management Framework (EMF).

4.2 Objectives

The objectives of the assessment framework for the Edithvale and Bonbeach level crossing removal projects are to:

- set out how the three matters specified in the Scoping Requirements issued by the Minister for Planning are assessed:
  - groundwater
  - biodiversity
  - contaminated and acid sulfate soils
- set out how any additional matters identified during preparation of the EES are assessed
- identify potential adverse environmental effects that require management
- provide a risk-based approach to enable a comparative evaluation of potential effects
- ensure the EES responds to statutory approval requirements, policies and guidelines that apply to the projects
- identify any changes to the projects' design or construction methodology necessary to address risks to the environment
- develop a robust EMF for the projects.

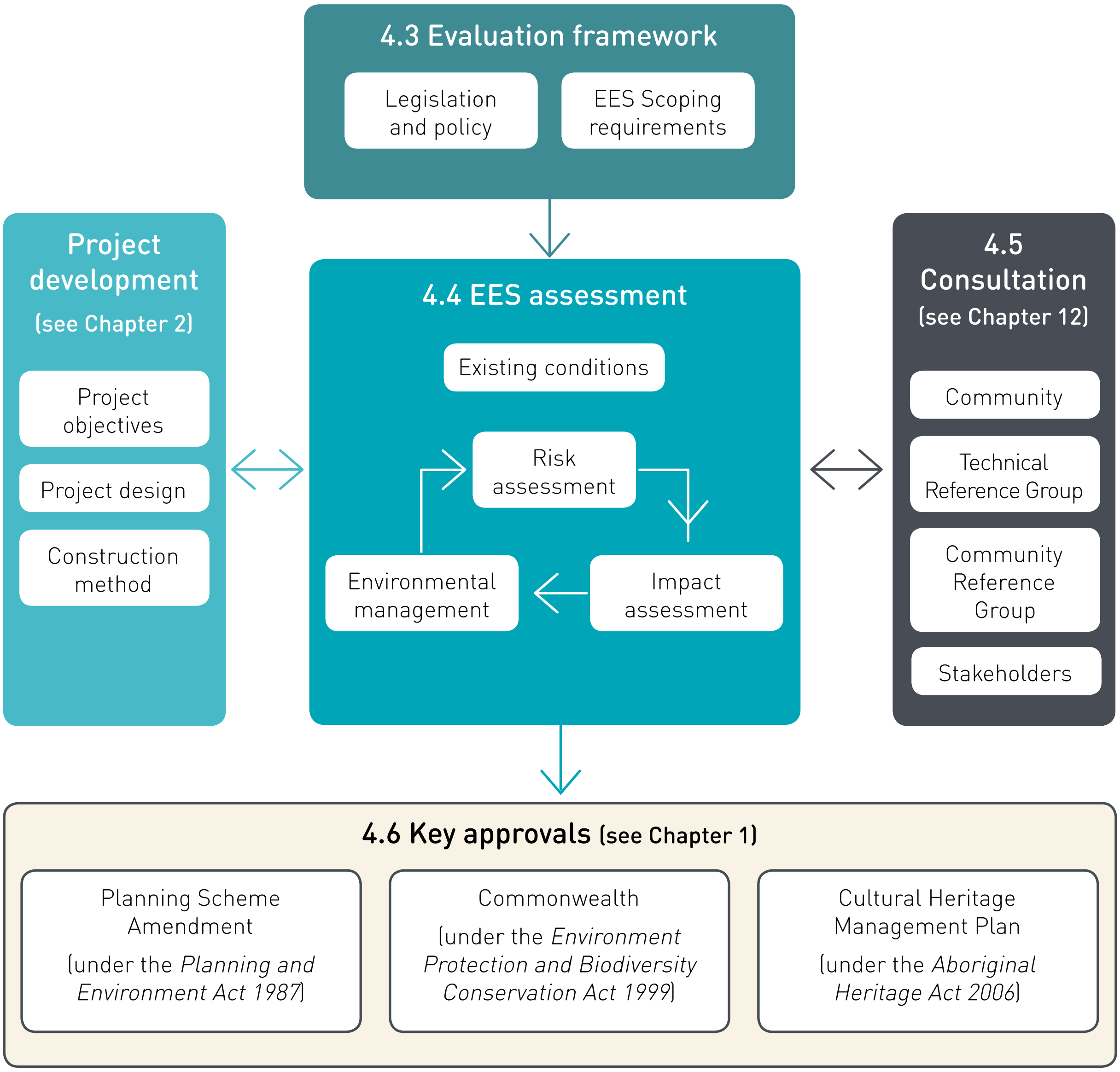
This assessment framework demonstrates how different components of the EES assessment process outlined in Figure 4.1 come together to provide a comprehensive assessment of the potential environmental effects of the Edithvale and Bonbeach level crossing removal projects and how this informs the approach to the environmental management of the projects.

The relationship between the components of the process are also shown in Figure 4.1 and described in further detail in this chapter.

Environment

'Environment' is a broad term that includes ecological, cultural, social, heritage, health, safety and economic aspects.

Figure 4.1 Components of the EES assessment process



4.3 Evaluation framework

The legislation, policies and guidelines relevant to the draft EES evaluation objectives established by the Scoping Requirements for the Edithvale and Bonbeach level crossing removal projects are outlined in Table 4.1. This is the regulatory framework which drives much of the assessment presented in the EES. The table indicates where further information can be found within the EES main report, attachments and technical reports.

A complete list and description of all applicable legislation, policy and guidelines considered for the EES is provided in Attachment I *Legislation and policy*.

Table 4.1 EES draft evaluation objectives and corresponding legislation, policy and guidelines

Draft evaluation objectives	Key legislation	Policies and guidelines	Further information
Groundwater To minimise effects on the regional groundwater regime and quality, particularly as they might impact on the hydrology of the Edithvale-Seaford Wetlands and elsewhere on other beneficial users.	*Environment Protection and Biodiversity Conservation Act 1999* *National Environment Protection Council Act 1994* *Environment Protection Act 1970* *Water Act 1989* *National Water Quality Management Strategy 1994*	*State Environment Protection Policy (Groundwaters of Victoria)* *National Environment Protection (Assessment of Site Contamination) Measure (NEPC 2013)*	Chapter 5 *Modelling the water environment* Technical Report A *Groundwater*
Biodiversity To avoid, minimise and/or offset adverse effects on native vegetation, listed threatened species and ecological communities, listed migratory species, the Ramsar listed Edithvale-Seaford Wetlands, other protected flora and fauna and groundwater dependent ecosystems.	*Environment and Biodiversity Protection Act 1999* *Planning and Environment Act 1987*, including Kingston Planning Scheme *Flora and Fauna Guarantee Act 1988* *Wildlife Act 1975* *Fisheries Act 1995* *Catchment and Land Protection Act 1994*	*Guidelines for the removal, destruction or lopping of native vegetation (DELWP 2017)*	Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* Chapter 8 *Potential local impacts at Edithvale and Bonbeach* Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems* Technical Appendix D *Ecology: Project Areas*

Draft evaluation objectives	Key legislation	Policies and guidelines	Further information
Acid sulfate soils and contamination To prevent adverse environmental or health effects from disturbing, storing or influencing the transport/movement of contaminated or acid-forming material.	*Environment Protection Act 1970* *Planning and Environment Act 1987* *Catchment and Land Protection Act 1994*	*State Environmental Protection Policy (SEPP), Prevention and Management of Contamination of Land* *Industrial Waste Resource Guidelines* *Industrial Waste Management Policy (Waste Acid Sulfate Soils) Special Gazette S125 published on 18 August 1999* *Best Practice Environmental Guidelines (BPEG), Environmental Guidelines for Major Construction Sites*	Chapter 7 *Acid sulfate soils and contamination* Chapter 8 *Potential local impacts at Edithvale and Bonbeach* Technical Report C *Acid Sulfate Soils and Contamination*

4.4 EES assessment

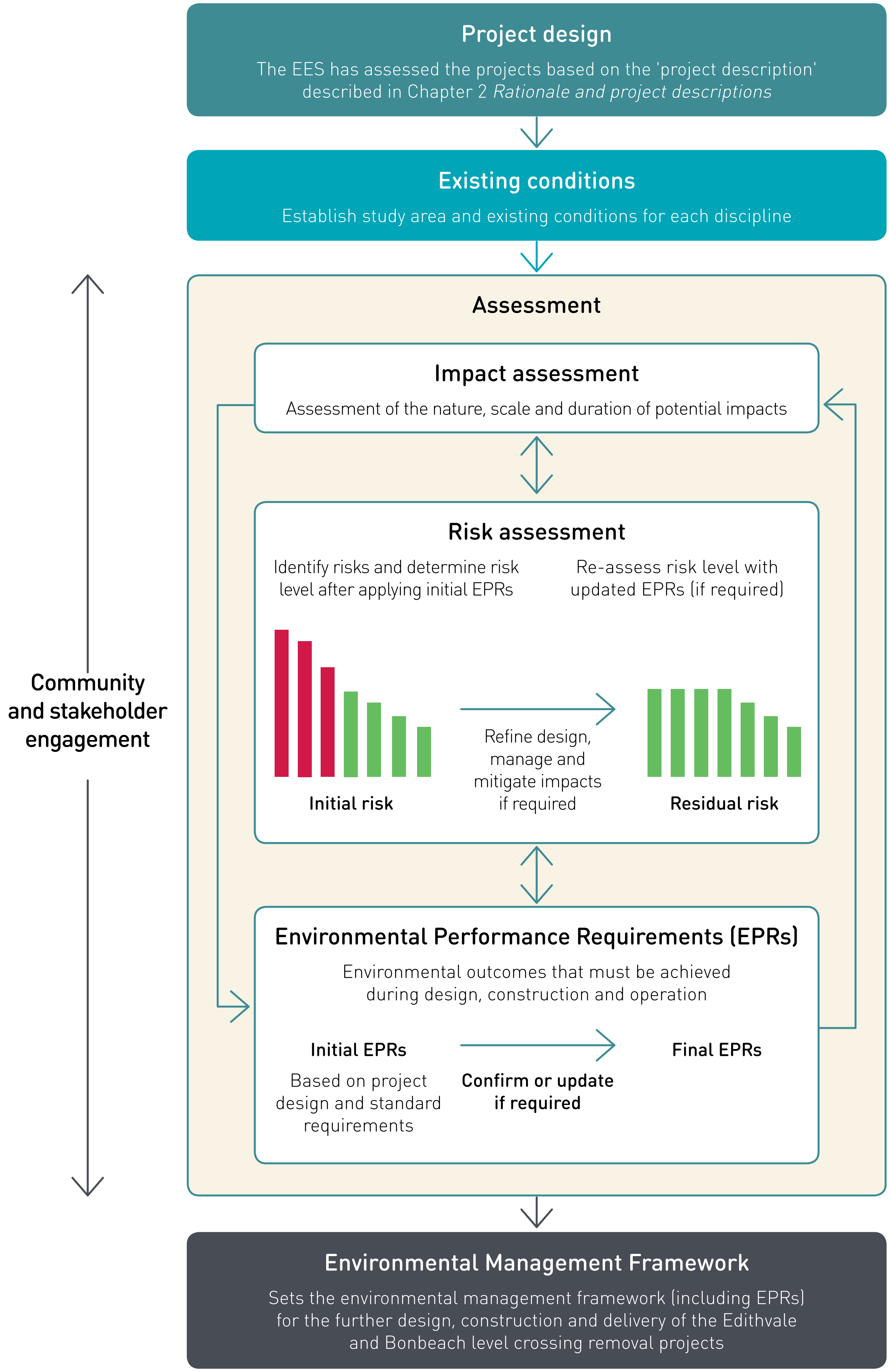
The Scoping Requirements issued by the Minister for Planning require a focus on three key issues: groundwater, biodiversity, and contamination and acid sulfate soils. The Scoping Requirements include specific draft evaluation objectives for each of these issues that have been used to guide the EES assessment.

The EES and supporting assessments have therefore focused on these three key areas.

LXRA has also undertaken a range of other studies to identify any other potential adverse environmental effects of the projects to ensure that they are identified, avoided, minimised or effectively managed.

The EES assessment has used a systematic risk-based approach to understanding the existing environment, the potential impacts of the projects on the environment and to evaluate the effectiveness of measures to avoid, minimise or manage the risk of impact. The process is set out in Figure 4.2 and described in Sections 4.4.1 to 4.4.7.

Figure 4.2 The EES assessment framework


Project design
The EES has assessed the projects based on the 'project description' described in Chapter 2 *Rationale and project descriptions*
Existing conditions
Establish study area and existing conditions for each discipline
Assessment
Impact assessment
Assessment of the nature, scale and duration of potential impacts
Risk assessment
Identify risks and determine risk level after applying initial EPRs
Re-assess risk level with updated EPRs (if required)
Refine design, manage and mitigate impacts if required
Initial risk
Residual risk
Environmental Performance Requirements (EPRs)
Environmental outcomes that must be achieved during design, construction and operation
Initial EPRs
Based on project design and standard requirements
Confirm or update if required
Final EPRs
Community and stakeholder engagement
Environmental Management Framework
Sets the environmental management framework (including EPRs) for the further design, construction and delivery of the Edithvale and Bonbeach level crossing removal projects

4.4.1 Studies responding to draft EES evaluation objectives in Section 4 of the Scoping Requirements

Studies responding to the draft evaluation objectives cover the following:

1. Groundwater
2. Biodiversity, with a particular emphasis on groundwater dependent ecosystem, such as the Edithvale-Seaford Wetlands that could be affected by the projects
3. Contamination and acid sulfate soils.

The studies on these aspects are provided in Technical Reports A to C and discussed in detail in Chapters 5 to 7. These three studies have undergone a peer review by an independent specialist.

4.4.2 Studies responding to Section 3.5 of the Scoping Requirements

LXRA has also undertaken a range of studies to address the remaining environmental aspects potentially affected by the projects. These studies will inform the preparation of an EMF to address Section 3.5 of the Scoping Requirements.

Studies were undertaken to address the following issues:

- ecology (within the project areas)
- surface water
- land use and planning
- traffic
- noise and vibration
- air quality
- landscape and visual
- business
- social
- Aboriginal cultural heritage
- historic cultural heritage.

4.4.3 Existing conditions

The assessment of the current condition of the environment is called an existing conditions assessment. An existing conditions assessment identifies the environmental context for the projects and provides the baseline conditions for the impact assessment. Each of the 14 specialist studies completed for this EES undertook an existing conditions assessment, which collectively provides the environmental context for the projects.

Each study considered the area within which potential effects could occur (the zone of influence, or study area). In some cases, this area extends beyond the project areas presented in Chapter 1 *Introduction*.

For example, the existing conditions assessment for air quality considered the current air quality at and around the Edithvale and Bonbeach project areas, and the location of residences, schools and parks close to the project areas that could be affected by changes to air quality, whereas the existing conditions assessment for the landscape and visual impact assessment considered an area of 500 metres from the proposed infrastructure. Beyond this distance, it was anticipated that the combined effects of distance, intervening landform, built form and vegetation would combine to ensure there are no potential landscape and visual effects.

The existing conditions for each of the specialist studies are summarised in EES Chapters 5 to 8 and detailed in the specialist Technical Reports A to N.

Peer review

The following specialist studies were independently peer reviewed:

- Groundwater
- Ecology: Wetlands and Groundwater Dependent Ecosystems
- Acid Sulfate Soils and Contamination.

The reviewer considered the assumptions, methodology, assessment criteria and scope applied in the reports. They also reviewed the results to ensure their consistency with the methodology adopted. The final peer review reports are appended to the three specialist reports listed.

4.4.4 Impact assessment

A change that would result from the implementation of the projects is called an impact. The nature and extent of any impact is measured against the existing conditions assessment.

The following factors may be considered when determining the significance of potential environmental impacts of the projects:

- magnitude, extent and duration of impact on aspects of the environment
- the relationship between different impacts on the environment
- the likely effectiveness of measures to avoid, minimise and manage impacts
- the likelihood that any given environmental impact would occur
- benchmarks and requirements set by statutory requirements and environmental approvals
- the policies and guidelines that apply to the proposed projects
- community expectations
- the principles of ecologically sustainable development as defined in the *Ministerial guidelines for assessment of environmental effects* (DSE 2006).

The impact assessments for each of the specialist studies are summarised in Chapters 7-11 and detailed in the specialist Technical Reports A to N. The studies recommended EPRs to manage and mitigate impacts. Where potential impacts were determined to be unacceptable, the specialists identified additional or revised EPRs that could be adopted to reduce risks and impacts. Where additional EPRs were identified, the risk assessment was revised to determine the residual risk, taking into account the final EPRs.

4.4.5 Risk assessment

The risk assessment was conducted using an approach which is consistent with AS/NZS ISO 31000:2009 Risk Management Process.

The overall risk management process involves the following steps:

- establishment of the context of the risk assessment
- risk identification
- risk analysis
- risk evaluation
- risk treatment.

Definition of risk

Risk can be defined as a combination of:

- the **likelihood** of an event occurring
- the magnitude of potential **consequences** of the event.

The risk assessment combines the likelihood of an impact occurring and the consequences if that impact was to occur, to arrive at an overall risk rating.

Assigning likelihood of risks

For the purposes of this risk assessment, the likelihood was determined in consideration of both the likelihood of an event occurring, and the likelihood of that event causing an impact. An overall likelihood rating was assigned using the guide in Table 4.2 below which has been used for other EESs in Victoria.

Table 4.2 Likelihood guide

Qualitative descriptors	Basis
Certain	Certain, or as near to as makes no difference
Almost certain	One or more incidents of a similar nature has occurred here
Highly probable	A previous incident of a similar nature has occurred here
Possible	Could have occurred already without intervention
Unlikely	Recorded recently elsewhere
Very unlikely	It has happened elsewhere
Highly improbable	Published information exists, but in a slightly different context
Almost impossible	No published information on a similar case

Assigning the consequences of risks

In this risk assessment, the consequences of a risk occurring was assigned by specialists using a consequence guide.

Consequence levels may be described in terms of multiple factors (e.g. magnitude, extent and duration). The purpose of the consequence guide is to achieve consistency when estimating consequence levels across the different technical disciplines (such as air, noise, visual, ecology) and over four main categories (social, environmental, economic and public health and safety).

The consequence guide in Table 4.3 presents an example of the type of information included in the consequence table. A full version of the consequence table is provided in the risk report (EES Attachment II *Environmental risk report*) and has specific consequence descriptions for each of the specialist investigations.

Table 4.3 Example consequence guide

Qualitative descriptors	Negligible	Minor	Moderate	Major	Extreme
Generic Consequence Description	Minimal, if any impact for some communities. Potentially some impact for a small number (<10) of individuals	Low level of impact for some communities, or high impact for a small number (<10) of individuals	High level of impact for some communities, or moderate impact for communities area-wide	High level of impact for communities area-wide	High level of impact state-wide

The consequence table used in the risk assessment is based on similar guides used in other Victorian EESs and has been tailored for this EES based on advice and input from the study specialists.

Risk workshops

The risk assessment process included workshops with a wide range of experts including the specialists responsible for preparing the technical assessments that inform the EES, design engineers, construction specialists and community engagement and consultation specialists.

The risk workshops involved the following steps:

- risk identification
- risk analysis
- risk evaluation.

A list of potential risks was developed for each project with subject matter specialists, and provided to workshop attendees for review prior to the workshop. Cumulative risks from the concurrent construction of both projects were also considered. This preliminary list was then reviewed at the workshop and amended with input from workshop participants.

Risk profile

A risk profile is a bar graph which summarises the outputs of the risk assessment so that easy comparison can be made between major, moderate and minor risks.

Risks were analysed by assigning likelihood and consequence ratings.

The likelihood of occurrence for each of the risks was estimated for the construction phase of the projects and the operation phase as relevant. The subject matter specialists were asked to use their expert knowledge and assign best estimate consequences for the risks relevant to their discipline.

The likelihood and consequence ratings assume that any management and mitigation measures to reduce the level of risk are in place (see Section 4.4.6 below).

The outputs from the workshops were entered into a risk model, which produced risk profiles showing the overall risk level, as well as individual components (environment, social, economic and public health and safety) that contribute to the risks.

The level of risks and potential impacts have been continually reviewed throughout the EES assessment process and have been updated as necessary in light of specialist investigations and as understanding of the potential impacts of the projects has increased.

4.4.6 Environmental management

The Environmental Performance Requirements (EPRs) define the environmental outcomes that must be achieved during design, construction and operation of the Edithvale and Bonbeach level crossing removal projects, regardless of the detailed design solutions adopted.

The 14 technical specialists developed an initial set of EPRs as part of their impact assessments. These initial EPRs were based on compliance with legislation and standard requirements that are typically incorporated into the delivery of construction contracts for rail projects. These assessments evaluated the environmental effects of the projects and the proposed construction methodologies. Through the risk assessment process outlined above, the initial set of EPRs was refined to a final set of EPRs.

A complete list of EPRs is set out in Chapter 9 *Environmental Management Framework*.

Avoid, minimise or manage hierarchy

The EES assessment framework adopts the following approach when a potential environmental impact is identified:

1. Avoid the impact – through changing a design parameter or construction approach
2. Minimise the impact – if an impact cannot be avoided, the design or construction approach would be changed so that the potential impacts are minimised
3. Manage the impact – if an impact cannot be avoided or minimised, effective management controls would be put in place to ensure that the potential impacts are reduced to acceptable levels.

4.4.7 Integrated assessment

Each specialist has worked closely with others to ensure that any relationships between the different studies that inform the EES have been identified.

To fully identify and assess potential impacts, the EES has given consideration to the existing conditions and potential impacts relevant not only to each aspect of the environment in isolation, but also impacts that may result when various aspects of the environment are considered together.

This may include the use of data collected by another discipline, or the reliance on one study's result to inform the assessment in another study. The clearest example of this is the critical dependency the wetland ecology assessment has on the outputs of the groundwater modelling. Without the modelling results, the potential impacts to the Ramsar listed Edithvale-Seaford Wetlands cannot be determined.

EPRs for individual specialist topics do not operate in isolation. In assessing impacts and risk, the impact assessment studies have cross-referenced EPRs from other technical areas as relevant.

The interactions were identified through concurrent preparation of the scopes for each technical assessment, scheduling assessments simultaneously to ensure necessary information was available and the integrated risk-based approach outlined above.

4.5 Consultation

Consultation was undertaken during the early investigations, options assessment and design development stages of the projects. As discussed in Chapter 12 *Community and stakeholder engagement*, LXRA undertook significant community consultation prior to the preparation of the EES to help understand concerns ahead of determining a design solution.

During the EES phase, councils and relevant government agencies were engaged through the EES Technical Reference Group (TRG). The TRG provided advice to the project team on key issues and concerns from their respective areas of interest. This ongoing engagement has enabled the key issues and interests of state and local government to be incorporated into the EES.

A Community Reference Group (CRG) was also formed with an independent chairperson to strengthen links with the community and to share information about the ongoing development of the projects. The CRG would continue to meet through the further development and delivery of the projects. The group supported broader engagement activities including community workshops and one-on-one meetings. This engagement provided an understanding of the concerns and preferred outcomes of local residents, businesses and other interested parties and ensured that these were considered in the design and assessment process.

Chapter 12 *Community and stakeholder engagement* describes where community and stakeholder feedback has informed the project design development and the EES.

4.6 Key approvals

As discussed in Chapter 1 *Introduction*, the key approvals required for the projects are:

- Commonwealth approval by the under the *Environment Protection and Biodiversity Conservation Act 1999*
- Planning Scheme Amendment under the *Planning and Environment Act 1987*
- Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006*.

These are summarised in Chapter 1 *Introduction* with details of the applicable legislation provided in Attachment I *Legislation and policy*.

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5 MODELLING THE WATER ENVIRONMENT

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This chapter summarises the methodology adopted to assess potential impacts of the projects on the groundwater regime, the local hydrology and water balance of the Edithvale Wetland portion of the Edithvale-Seaford Wetlands, and ecosystems that depend on the existing water regimes in these systems. This chapter also presents the results of water and groundwater modelling and discusses the potential impacts that result from changes to the groundwater regime.

The Scoping Requirements for the EES include the following evaluation objective:

- **Groundwater** – to minimise effects on the regional groundwater regime and quality, particularly as they might impact on the hydrology of the Edithvale-Seaford Wetlands and elsewhere on other beneficial uses.

To assess the potential effects on the groundwater regime, several modelling approaches were developed, including a regional numerical groundwater model and local wetland hydrological model for Edithvale Wetland. The key findings of the models are presented below, with detailed modelling reports included in Technical Report A *Groundwater*. Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* contains relevant ecology information and assessment of related impacts, including those that may arise due to the predicted changes to groundwater discussed in this chapter.

The study area incorporates the project area as defined in Chapter 2 *Rationale and project descriptions* as well as the broader area bound by Port Phillip Bay in the west, Patterson River in the south, the eastern extent of the Edithvale Wetland portion of the Ramsar site in the east and Lochiel Avenue to the north.

A summary of the key findings from this chapter is presented in Table 5.1.

Table 5.1 Summary of key findings

Topic	Key finding
Edithvale	The proposed trench at Edithvale has the potential to exacerbate existing water logging as a result of groundwater intersecting with the surface. The project would be designed to avoid this impact and ensure no significant impacts to the environment occur. A engineering solution has been developed and modelled using the peer reviewed groundwater model prepared for the EES to demonstrate this outcome is achievable.
Bonbeach	Groundwater flows in a different direction at Bonbeach compared to Edithvale and mounding is not predicted to cause water logging at this project.

5.1 What is groundwater?

Groundwater is water located beneath the earth's surface. It is found in vast quantities, usually occurring through the filling of pores and fractures between grains of soil or rock, similar to how a sponge holds water. Groundwater is studied through the branch of geology called hydrogeology.

Groundwater is sourced from water that originates above the ground – either from rain that has seeped into the soils, or from surface water from rivers, streams and other waterways that has seeped into the subsurface. Groundwater relies upon this connection with rainfall and surface water to be 'recharged', and as a result, it is a finite resource. It slowly flows into underground soil and rock layers. There are two main types of these layers:

- **aquifers** – are geological materials such as unconsolidated sediments (gravel, sand or silt), permeable rock or fractured rock that could contain water. Groundwater generally flows within an aquifer as they are typically permeable
- **aquitards** – are soil or rock layers that could store water but are relatively impermeable, which limits the amount of groundwater flow that could occur.

The upper surface of the zone of saturation within an aquifer is known as the 'water table', which occurs at atmospheric pressure. Above the water table is the unsaturated zone, which occurs at lower than atmospheric pressure and can extend from the ground surface to the water table. The unsaturated zone can include moisture that is retained in soil and rock through capillary action, which occurs where a liquid can flow in narrow spaces without the assistance of external forces like gravity.

Both the saturated and unsaturated zones can intersect the ground surface at rivers, streams, lakes and wetlands. Groundwater (typically from within the unsaturated zone), can be relied upon as a water source for flora (vegetation such as trees when it occurs within the root zone of the vegetation). Fauna (for either land or water-based animals) may rely upon groundwater also. Within the project areas, examples of ecosystems that could potentially show some dependence on groundwater include the flora along the coastal dune and the flora and fauna within Edithvale Wetland and Wannarkladdin Wetlands.

5.1.1 How groundwater moves

Like in a river, groundwater flows from areas of high water elevation to areas of low water elevation. Therefore groundwater will flow from topographic high points, towards topographic depressions and low points (refer to Figure 5.1).

A groundwater flow regime describes the movement of groundwater through rocks and soil, which is driven by recharge and discharge processes. Recharge and discharge could be considered as the 'input' and 'output' of an aquifer system, and are variable and dependent on several factors such as climate (low rainfall means less water is available to be recharged) and land use (more impermeable surfaces means less water is available to be recharged).

For this study, groundwater flow regimes have been characterised as being ether local or regional. These characterisations are related to depth and length of flow paths.

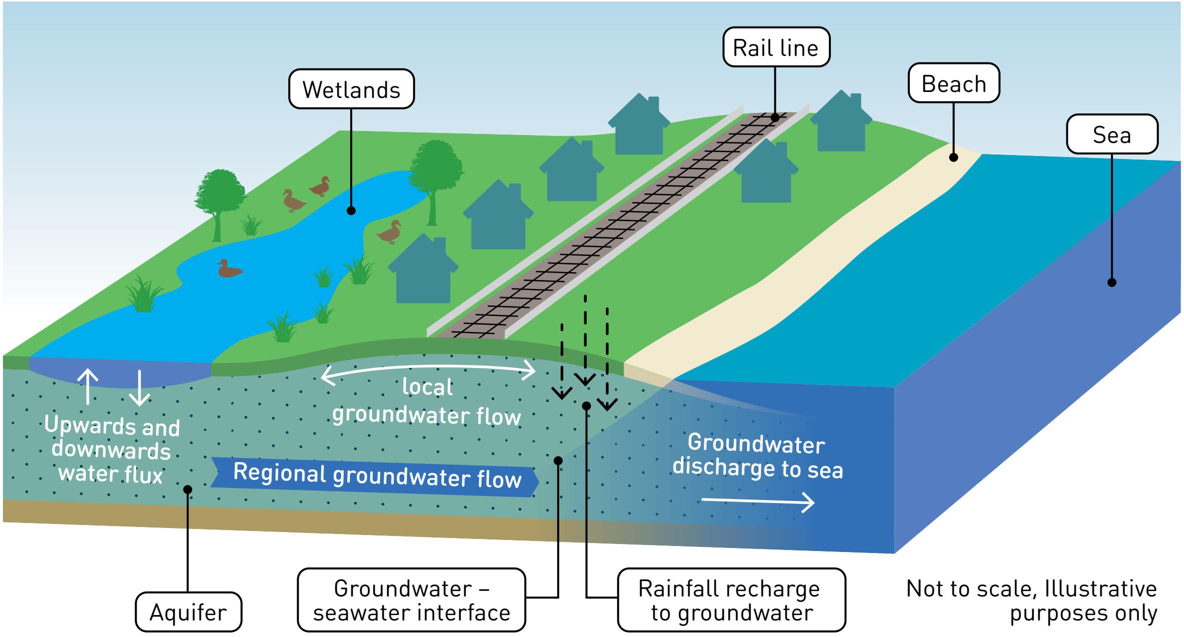
- **Local groundwater** flow regimes describe local variations in flow directions in response to local undulations in topography. Such local regimes occur close to the ground surface and are seasonally dynamic, responding to temporal variations in recharge processes. Local flow regimes are usually associated with shallow groundwater. Figure 5.1 provides a conceptual example of local flow through the arrow indicating shallow groundwater flowing towards the wetland.
- **Regional groundwater** flow regimes describe regional variations in flow directions driven by regional differences in topography and the location of regional recharge and discharge zones. Such regional regimes typically occur on a catchment scale, with groundwater flowing over distances of several kilometres at depths greater than the local regimes. Since most parts of the regional flow regimes are deep, they are less responsive to seasonal variations in groundwater recharge. Figure 5.1 provides a conceptual example of regional flow through the deeper arrow indicating groundwater flow towards the bay.

At the Edithvale and Bonbeach project sites there is an interaction between local and regional groundwater flows.

The local groundwater flow regimes at the project area are influenced by the surface topography which includes a coastal dune network. The rail line has been constructed generally along the top of this dune network. To the east of the dunes, local groundwater tends to flow in an easterly direction inland. To the west of the dune network, local groundwater tends to flow west toward Port Phillip Bay. At Bonbeach, local groundwater flows in a generally south to south westerly direction towards Patterson River.

The interaction between local and regional groundwater regimes are shown in Figure 5.1.

Figure 5.1 Conceptual diagram of groundwater flow


Rail line
Wetlands
Beach
Sea
local groundwater flow
Upwards and downwards water flux
Regional groundwater flow
Groundwater discharge to sea
Aquifer
Groundwater – seawater interface
Rainfall recharge to groundwater

Not to scale, Illustrative purposes only

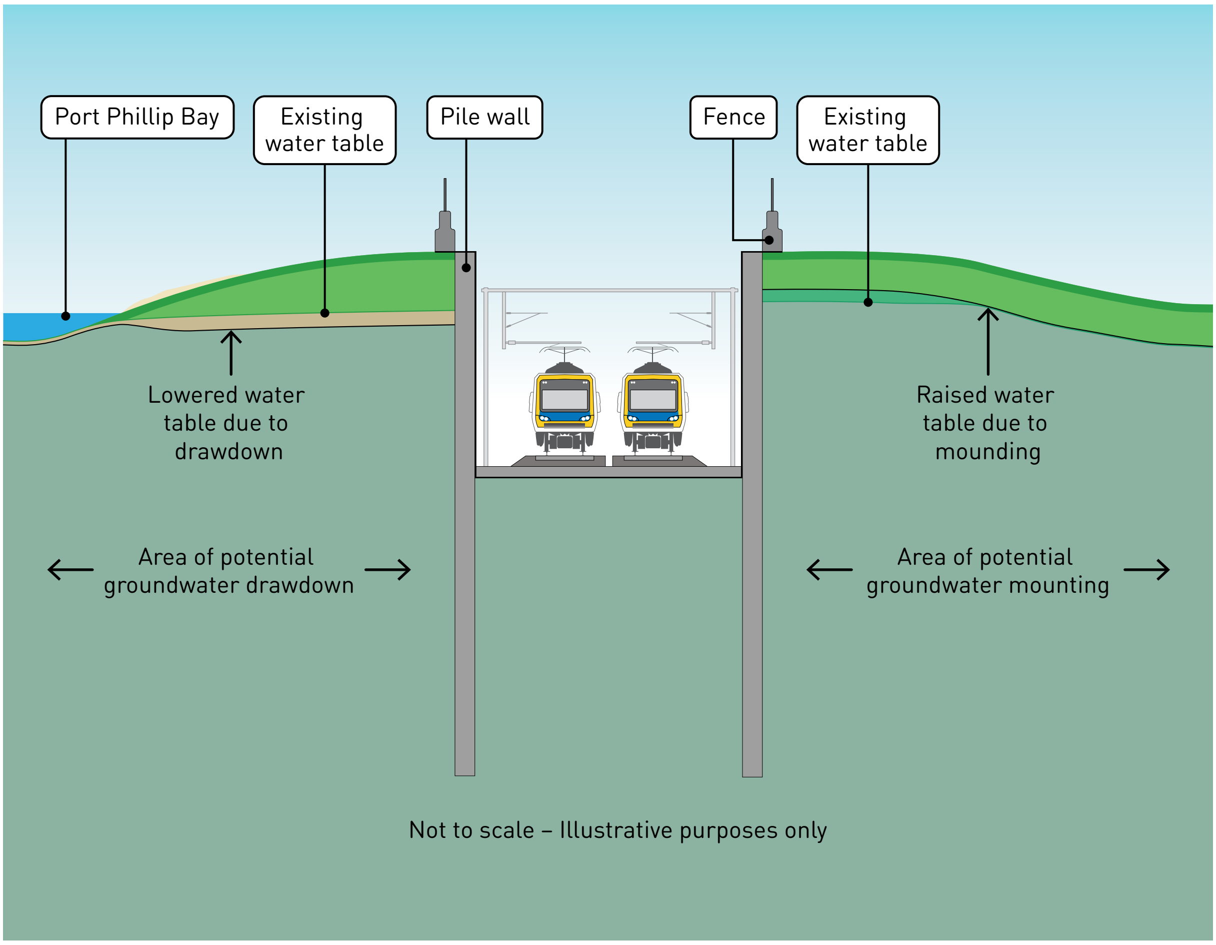
5.1.2 Why groundwater levels change

The depth to the water table changes over time and is subject to the geology, landscape setting, land use and climate. Within the project areas, groundwater levels are generally shallow, which is typical of relatively flat coastal settings that occur close to sea level.

While fluctuations in the water table occur naturally (for example, the water table would become deeper during a drought due to less rainfall recharge), human-induced water table fluctuations could also occur. The most relevant project-induced changes to the water table are outlined below and shown conceptually in Figure 5.2:

- **Groundwater 'drawdown'** refers to the lowering of the water table from the existing groundwater level. This occurs through removing water from the aquifer system, for example by extracting groundwater by pumping, or obstructing the flow of groundwater, similar to surface water levels dropping downstream of a dam. Figure 5.2 shows the potential water table drawdown that could occur on the coastal side of the rail trench due to the pile walls required for the project.
- **Groundwater 'mounding'** refers to the raising of the water table from the existing groundwater level. This occurs through adding water to the aquifer system, for example by increased recharge, or by obstructing the flow of groundwater, similar to surface water levels rising upstream of a dam. Figure 5.2 shows the potential water table mounding that could occur on the inland side of the rail trench due to the pile walls required for the project.

Figure 5.2 Conceptual diagram of potential groundwater drawdown and groundwater mounding


Port Phillip Bay
Existing water table
Pile wall
Fence
Existing water table
Lowered water table due to drawdown
Raised water table due to mounding
Area of potential groundwater drawdown
Area of potential groundwater mounting
Not to scale – Illustrative purposes only

5.1.3 Groundwater concepts

Groundwater can have many and varied uses that may benefit people and the environment – these are generally referred to as 'beneficial uses'. The main beneficial uses of groundwater relevant to the projects are outlined below:

- **Groundwater users** – Groundwater has long been used as a water resource in Australia, a continent with historically low and unreliable surface water resources. In Victoria, groundwater resources are used primarily for agriculture irrigation purposes, with use being typically seasonal, as irrigators usually pump groundwater in late spring and summer to address rainfall deficits. In addition, groundwater can be used for industrial or commercial purposes, for municipal supply or for stock or domestic purposes. Stock or domestic users are individuals living in both rural and urban areas who use groundwater for a variety of purposes such as garden watering, general household use (e.g. toilet flushing) and drinking water for stock. There are a number of groundwater bores in the Edithvale and Bonbeach area installed for the domestic use of groundwater.

  The use of groundwater for purposes other than stock and domestic purposes requires an extraction licence to be issued by the relevant water corporation, which is Southern Rural Water within the project areas. Uses other than 'stock and domestic' require a 'take and use' licence to be issued by the water corporation. Such licences would typically be issued to agribusiness users such as irrigators, commercial and industrial users. It is likely that additional unregistered groundwater users exist within the project area, based on the shallow depth to groundwater and likely high groundwater quality.

- **Groundwater dependent ecosystems (GDEs)** – A GDE is an ecosystem that is dependent on groundwater to meet all, or some of its water requirements to maintain its communities of plants and animals, ecological processes and ecosystem services.

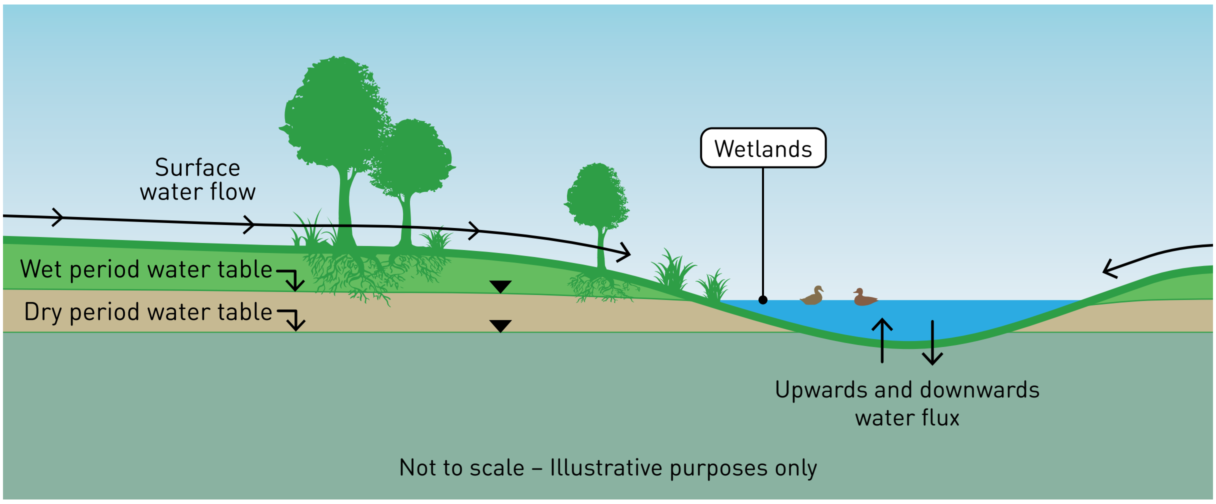
The types of GDEs which are most likely to occur in the study area include:

- **Terrestrial communities** that obtain at least part of their water requirements from groundwater, but are not totally reliant on surface waters
- **Wetland communities** in which groundwater provides at least seasonal water logging or inundation.

Surface water levels in wetlands are maintained by groundwater discharges known as baseflow. Groundwater can flow (discharge) into a wetland, if the wetland water level is lower than the surrounding groundwater level (refer to Figure 5.3).

The degree of groundwater dependence is reliant on the location setting (e.g. topography, geology, climate, surface water drainage, water table depth and vegetation rooting depth) and can be temporally variable (e.g. some vegetation may rely on groundwater during drought periods).

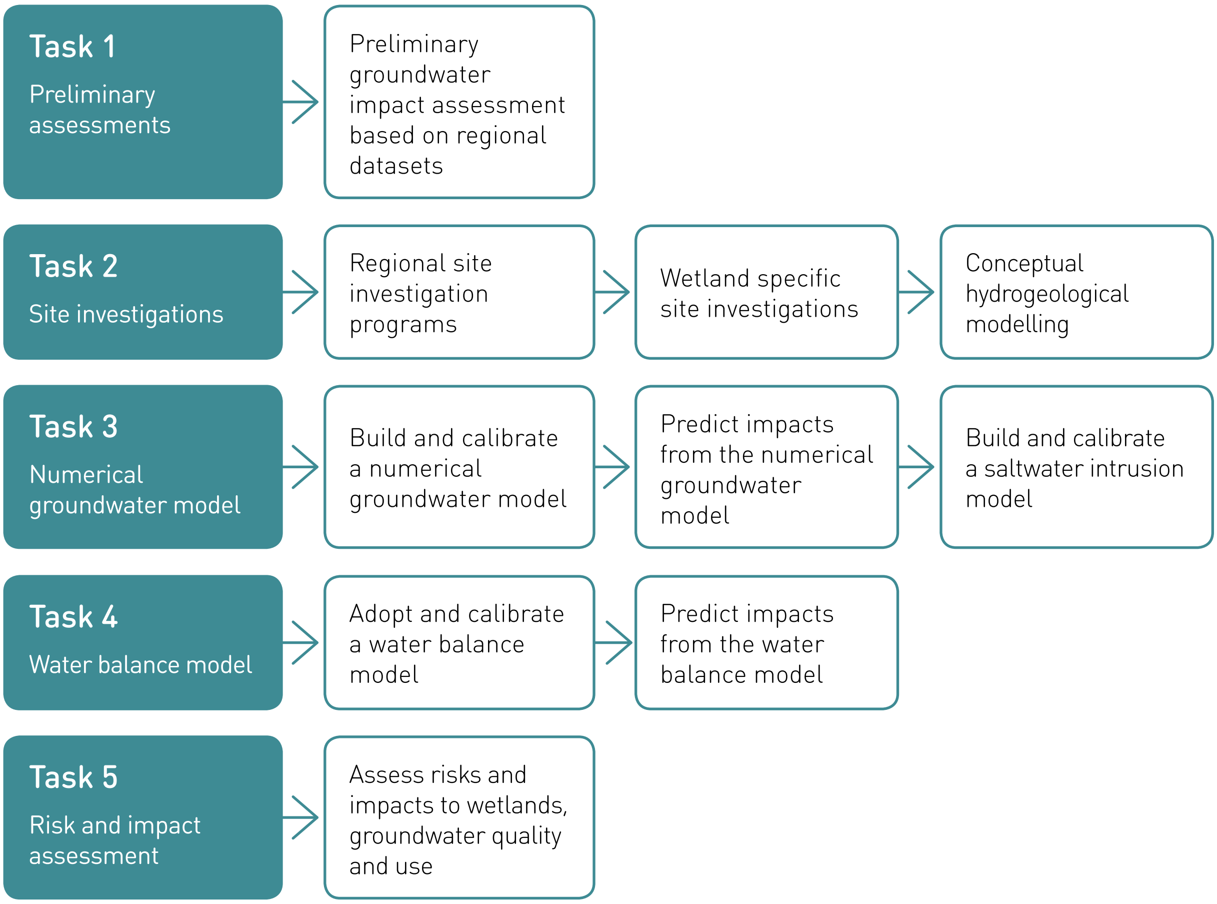
Figure 5.3 Groundwater dependent ecosystem


Surface water flow
Wetlands
Wet period water table
Dry period water table
Upwards and downwards water flux
Not to scale – Illustrative purposes only

5.2 Methodology

To assess the potential impacts of the projects on the regional groundwater regime, the local hydrology and water balance of Edithvale Wetland, and ecosystems that depend on the existing water regimes in these systems, the following key tasks were undertaken as set out in Figure 5.4.

Figure 5.4 Methodology undertaken for modelling the water environment


Task 1
Preliminary assessments
Preliminary groundwater impact assessment based on regional datasets
Task 2
Site investigations
Regional site investigation programs
Wetland specific site investigations
Conceptual hydrogeological modelling
Task 3
Numerical groundwater model
Build and calibrate a numerical groundwater model
Predict impacts from the numerical groundwater model
Build and calibrate a saltwater intrusion model
Task 4
Water balance model
Adopt and calibrate a water balance model
Predict impacts from the water balance model
Task 5
Risk and impact assessment
Assess risks and impacts to wetlands, groundwater quality and use

5.2.1 Task 1: Preliminary assessments

Prior to the Minister's requirement for an EES, a preliminary groundwater model was developed to predict potential effects on the groundwater regime associated with the proposed rail trenches. This model identified key risks resulting from the projects, including:

- potential impacts to GDEs, particularly Edithvale Wetland
- potential for acid sulfate soil activation
- an increase in the frequency, duration and extent of existing water logging in areas close to the proposed trenches.

5.2.2 Task 2: Site investigations

Regional site investigation

A regional geotechnical, hydrogeological and environmental site investigation program was conducted along the Frankston rail line, between Cheltenham in the north and Frankston in the south. This program involved the drilling of boreholes to assess the properties of soil and rock (geotechnical investigation), installation, monitoring and testing of groundwater monitoring bores (hydrogeological investigation) and opportunistic sampling of soil and groundwater for contaminants of potential concern (environmental investigation).

The investigation included the drilling of 146 geotechnical bores and the installation of groundwater monitoring bores in 121 of these bores. The purpose of this investigation was to improve the understanding of existing ground conditions and groundwater levels, quality and permeability within the various aquifers, facilitate salinity profiling and improve understanding of the vertical and horizontal movement of groundwater within and between aquifers, as they relate to the project areas near the rail trenches.

Wetland site investigation

A hydrogeological and ecological site investigation program was conducted within Edithvale Wetland to inform groundwater and hydrological modelling, and inform the assessment of potential impacts to sensitive receptors as a result of the projects. The monitoring objectives for the wetland site investigation were to:

- improve understanding of local surface water and groundwater levels and quality trends within the wetlands
- improve understanding of local groundwater-surface water interactions
- improve understanding of temporal reliance of identified ecological vegetation to surface water and groundwater, to inform the ecological assessment
- improve understanding of local interactions between various aquifers
- validate numerical groundwater and hydrological model outputs.

This investigation included the installation of five shallow surface water level gauges. Data loggers were deployed in each gauge to record surface water levels at hourly intervals. Surface water was sampled and analysed at selected wetland cells.

A total of nine groundwater monitoring bores were also installed at the Edithvale Wetland. Data loggers were deployed in each bore to measure groundwater levels at hourly intervals. Groundwater sampling and analysis was undertaken at each bore to assess groundwater quality at the wetlands. The purpose of the surface water and groundwater samples was to compare the chemical signatures of surface water with those of groundwater, to inform the understanding of local connectivity across the Edithvale Wetland. This enabled the conceptualisation of water inflows and outflows to the wetlands to be updated. It also informed the conceptualisation of the wetland system as it relates to the project areas. Groundwater permeability was also tested in each bore to estimate the flow rate of groundwater in the relevant aquifers, which formed inputs to the modelling undertaken.

Opportunistic sampling and laboratory analysis of clay encountered during groundwater bore drilling was also undertaken, to confirm the low permeability of these units and inform the conceptualisation of flow systems at the Edithvale Wetland.

The surface water gauges and groundwater monitoring bores installed for this investigation remain in place and are central to a local groundwater and surface water monitoring program at Edithvale Wetland.

5.2.3 Task 3: Numerical groundwater model development

Building the numerical groundwater model

A numerical groundwater model was developed to predict potential groundwater drawdown and mounding effects associated with the proposed rail trenches. The model used available topographical, lithological and hydrological data.

Topographical, lithological and hydrological data

Topography refers to the elevation of the earth's surface, usually measured with respect to average sea level. Ground surface elevation is typically above sea level, but inland depressions can occur, usually forming terminal hydrological features, such as the Edithvale-Seaford Wetlands.

Hydrology refers to the study of water above the ground surface, and includes rivers, creek, lakes, wetlands, the sea and man-made features such as ponds, channels and culverts. Natural hydrological features may interact with groundwater.

The physical characteristics of geological layers are described by lithological data, which can include rock or soil types, colour, grain sizes, texture and structure. The relationships of lithology with respect to depositional time period is referred to as stratigraphy, or when discussing aquifers, hydrostratigraphy.

Model calibration

For a groundwater model to be used to make predictions about future groundwater conditions, it must be demonstrated that the model can plausibly simulate observed groundwater behaviour. Calibration is a process wherein certain parameters of the model such as recharge and flow rates are altered and numerous individual 'models' are run repeatedly until the solution matches field-observed values within an acceptable level of accuracy.

The model was calibrated using hydrological and climate data from the last 20 years (commencing in January 1997), including:

- groundwater level data obtained from DELWP Water Measurement Information System, including measurements from the regional State Observation Bore Network
- groundwater data obtained from the DELWP Victorian Aquifer Framework, a statewide dataset
- local groundwater and surface water level data from relevant locations provided by Melbourne Water
- lithological data obtained from the regional geotechnical investigation undertaken between Cheltenham and Frankston
- groundwater level and hydraulic conductivity data obtained from the local groundwater monitoring network installed for the projects between Cheltenham and Frankston.

Calibration included running the model for the period 1997 to 2017 and then matching the predictions of the model to the actual historical groundwater levels from 121 groundwater monitoring bores drilled and installed specifically for the project and 16 regional State Observation Bore Network with validated, long-term monitoring data. The 20-year model period was selected as it covers a period of extreme climatic conditions that included the 'Millenium Drought' and above average rainfall from 2010 to 2011. The Millennium Drought commenced with low rainfall conditions in late 1996, and by 2003 it was recognised as the worst drought recorded in Australia since European settlement.

Numerical groundwater model predictions

The numerical groundwater model was used to estimate potential changes to the groundwater regime around Edithvale and Bonbeach, as well as potential changes to local groundwater flow regimes at Edithvale Wetland resulting from the projects.

An 'initial assessment' was undertaken which included modelling of project operation based on an initial trench design. The results of the initial assessment showed that further design mitigation of impacts to the groundwater flow regime would be required at Edithvale, but not at Bonbeach.

A 'mitigated assessment' was subsequently undertaken based on a revised trench design, which assumed that an engineering solution was in place to minimise impacts to the groundwater flow regime, reduce initial risks and was used to assess residual risks. The results of the initial assessment and the mitigated assessment are discussed in Section 5.4.

Saltwater intrusion model

An assessment was undertaken of the potential significance of salinity changes as a result of the projects, through modelling of the changes in salinity concentrations within each relevant aquifer, based on the initial assessment. The numerical model comprised a two dimensional cross-section, taken along a representative west to east cross section alignment where the greatest changes in the elevation of the water table were predicted, based on the initial assessment.

The model was run over a 100-year simulation period, to predict the potential changes to the salinity concentration profile over the design life of the project. A longer period was adopted for the saltwater intrusion modelling (compared to the numerical groundwater model described previously) since changes to groundwater salinity resulting from saltwater intrusion could feasibly take hundreds of years before impacts are identified.

5.2.4 Task 4: Wetland hydrological model

Wetland hydrological model

A wetland hydrological model was built specifically for the projects using eWater Source, Australia's national hydrological modelling platform, to simulate detailed wetland hydraulics. The model represents the processes needed to quantify the wetland water balance including inflow, rainfall, evaporation and discharge, which the groundwater model is not designed to simulate in sufficient detail.

Water balance

The difference between a wetland's water inflows and outflows is known as its 'water balance'.

When averaged over a long period, the inflows appear to balance the outflows. However, at any time, one or more components of the balance may dominate. For example, heavy rainfall will cause water levels to rise temporarily. Alternatively, if groundwater levels decline, the wetland may become drier because groundwater inflows, or 'baseflows' decrease.

The wetland hydrological model enabled an integrated simulation of:

- the total wetland water balance (stormwater, baseflow and overland flow inputs; and evaporation, leakage to groundwater, and surface outflows)
- movements of surface water through and between wetland cells according to the relevant details of control structures such as weirs and pipes
- the resulting hydraulic dynamics of the wetlands, including wet versus dry wetland bed, and water depths, which are critical to assessing potential effects and risks of the projects to wetland ecological function.

The groundwater inflow/outflow component of the model was informed by outputs of the numerical groundwater model, which itself simulates the variable wetting and drying of each wetland cell using water level data provided by Melbourne Water, in conjunction with wetland bathymetry data. Bathymetry is the study and mapping of the underwater depth of the wetland floor, which was used to assess water levels. Refer to Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* for further information and to Appendix G of Technical Report A *Groundwater* for the wetland hydrological modelling report.

Following initial groundwater model calibration, the wetland hydrological model was updated to reflect the estimated groundwater inputs and outputs to/from the wetlands over the 20-year model period. For consistency, the same model period (1997-2017) was adopted in the wetland hydrological model and the numerical groundwater model. The model was subsequently recalibrated using observed wetland water levels to ensure its predictions of the future incorporated all available data.

For predictive modelling purposes, changes to groundwater discharge to/from the wetlands, as estimated by the groundwater model were incorporated into the wetland hydrological model. This enabled simulation of potential changes and risks to wetland hydraulics and ecology.

Wetland hydrological model predictions

The outputs from the groundwater and wetland hydrological models were used to quantify potential impacts and risks to GDEs, including the ecological function at Edithvale Wetland.

Potential changes to wetland water levels and wetland surface area were predicted by modelling scenarios with alternative baseflow and stream leakage, estimated by the numerical groundwater model, including:

- potential changes to baseflow considering hydrogeological parameter uncertainty
- potential changes to baseflow considering potential effects of climate change.

5.2.5 Task 5: Risk and impact assessment

A groundwater impact assessment was undertaken to quantify groundwater risks, based on the potential effects of the projects, as simulated using the various model predictions. The assessment considered potential impacts including:

- direct, indirect and cumulative risks to receptors
- sensitivity of the receptors to changes in flow regimes, water quality and water levels.

Risks were assessed during the construction and design/operation phases of the projects. Design and operation are considered together because the design determines how the trenches would affect groundwater in operation. For further details refer to Attachment II *Environmental Risk Report*. Changes to groundwater levels and groundwater flow regimes could occur following the construction of the pile walls, which as described in Chapter 2 *Rationale* and *project descriptions*, would obstruct groundwater through-flow. Because of these identified potential impacts, the pile wall configurations proposed at Edithvale and Bonbeach include measures that minimise potential impacts to groundwater, including stepped depths of impermeable piles.

Based on the likely depths that the pile walls would be installed, the most significant risk to groundwater resulting from the project would be caused by changes to local groundwater flow regimes, as described in Section 5.1.1. Regional flow regimes typically relate to deeper aquifers that are less likely to be affected by the projects. The risk of changes to groundwater flow regimes would commence during construction as soon as the pile walls are installed, and would continue for the life of the asset. Given the short period of construction (12-18 months) compared to the duration of operation (assumed to be at least 100 years), and to avoid repetition, changes to groundwater have been addressed as an 'operation' risk.

The impact assessment focused on project induced groundwater flow regime impacts resulting from groundwater level drawdown and mounding as a result of the projects. These include:

- short term construction impacts
- interference with local groundwater users
- interaction with existing contaminated or potentially contaminated groundwater
- changes to groundwater levels in the vicinity of GDEs (particularly Edithvale Wetland)
- potential for water logging
- potential for subsidence impacts
- potential for acid sulfate soil activation
- potential for saltwater intrusion.

Short term construction impacts

Short-term groundwater impacts such as groundwater 'drawdown' could occur during project construction. The potential for short-term impacts to groundwater (during construction) was assessed by way of a two-dimensional model program called PlaxFlow. Site specific lithological data and hydrogeological data obtained from field investigations were input to the computer program to undertake geotechnical analysis of deformation, stability and groundwater flow.

A model was set up to investigate:

- the drawdown versus time on either side of the pile walls
- the volume and flow rates of groundwater into the excavations.

Local groundwater users

Existing groundwater users were identified from the publicly available Water Measurement Information System and through liaison with Southern Rural Water.

The assessment involved comparing the available drawdown in each identified existing groundwater bore against the modelled predictions. If the interference at a bore exceeded 10 per cent of the available drawdown (in other words a 10 per cent or greater reduction in groundwater level within a bore), this would represent the potential to result in a measurable impact on the rate at which groundwater could be extracted from a groundwater bore.

Existing groundwater contamination

Potential groundwater contamination sources may be present at locations along the Frankston rail alignment.

There is potential for the projects to interfere with existing offsite groundwater contamination through project induced changes to groundwater flow paths that could occur during project construction or operation. Such interference could include redirection or redistribution of existing contaminant plumes in groundwater.

The groundwater model predictions were used to consider the potential interaction with existing identified or inferred groundwater contamination. The impacts associated with these potential interactions are assessed in Chapter 7 *Acid sulfate soils and contamination*.

Groundwater dependent ecosystems and surface water features

The types and occurrence of GDEs at Edithvale Wetland were identified through desktop database searches and physical field surveys discussed in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems*.

For Edithvale Wetland, a detailed assessment of the potential effects of the proposed project construction options on wetland ecological function was undertaken utilising the wetland hydrological model outputs. The wetland hydrological model facilitated translation of the changes in groundwater inflows and outflows at the wetlands, as simulated by the groundwater model, into changes in the wetting and drying cycles (frequencies and durations) at Edithvale Wetland. The changes to the wetting and drying cycles of specific areas of mapped habitat types across the wetlands were assessed.

For other GDEs, the assessment involved overlaying identified GDEs with the modelled mounding and drawdown outputs. A qualitative assessment was undertaken to consider potential impacts to these features as a result of the proposed projects.

These outputs feed directly into the broader ecological impact assessment of GDEs including the Edithvale Wetland (Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems*).

Water logging potential

Outputs from the numerical groundwater model were used to identify changes to the area currently showing groundwater levels at, or close to the ground surface under existing conditions. The assessment was undertaken quantitatively through spatial analysis, with the aim of predicting impacts relating to groundwater mounding, including water logging, impacts to vegetation, soil salinity or existing subsurface infrastructure.

Subsidence

Groundwater drawdowns predicted by the groundwater model were used to assess the potential for subsidence to occur as a result of the Edithvale and Bonbeach level crossing removals.

The risk of damage to buildings and other infrastructure would be dependent on the amount of settlement that may occur, and the tolerance of structures to such movement.

What is subsidence?

Groundwater-related subsidence is the sinking (subsidence) of land resulting from groundwater drawdown.

Land subsidence occurs when groundwater is withdrawn from certain types of saturated soil, such as fine-grained sediments. The soil compacts because the water is partly responsible for holding the ground up.

When the groundwater drains from pore spaces within the soil layers, the vertical load is redistributed from the water within the soil and onto the soil, which compacts the soil due to the redistributed load.

The related ground subsidence that occurs as a result of the reduction in water pressure in the soil layers can damage nearby structures or utilities.

Acid sulfate soil impacts

Acid sulfate soils contain higher concentrations of iron sulfides, or the products of sulfide oxidisation. Acid sulfate soils are safe when left undisturbed. When disturbed, the sulfides come into contact with oxygen, break down and generate sulfuric acid. This means that lowering of the water table in these sediments would have the potential to result in acidification of the soils through the introduction of oxygen, which, in turn can lead to acidification of groundwater. The generation of acid can degrade concrete foundations and slabs in contact with soils and groundwater. It can also result in the discharge of acidified groundwater to surface water systems, potentially affect ecosystems that rely on groundwater and cause acid runoff from soils.

Groundwater level change predictions from the groundwater model were used to inform the coastal acid sulfate soil (CASS) assessment of the potential for activation of acid sulfate soils as a result of the Edithvale and Bonbeach level crossing removals. Refer to Chapter 7 *Acid sulfate soils and contamination*.

Saltwater intrusion

There is a natural subsurface interface between where relatively fresh groundwater discharges to saline seawater along the coast. Figure 5.5 provides a conceptual diagram of the project areas, which shows both local and regional groundwater flow regimes discharging at the coast, as denoted by the blue arrows.

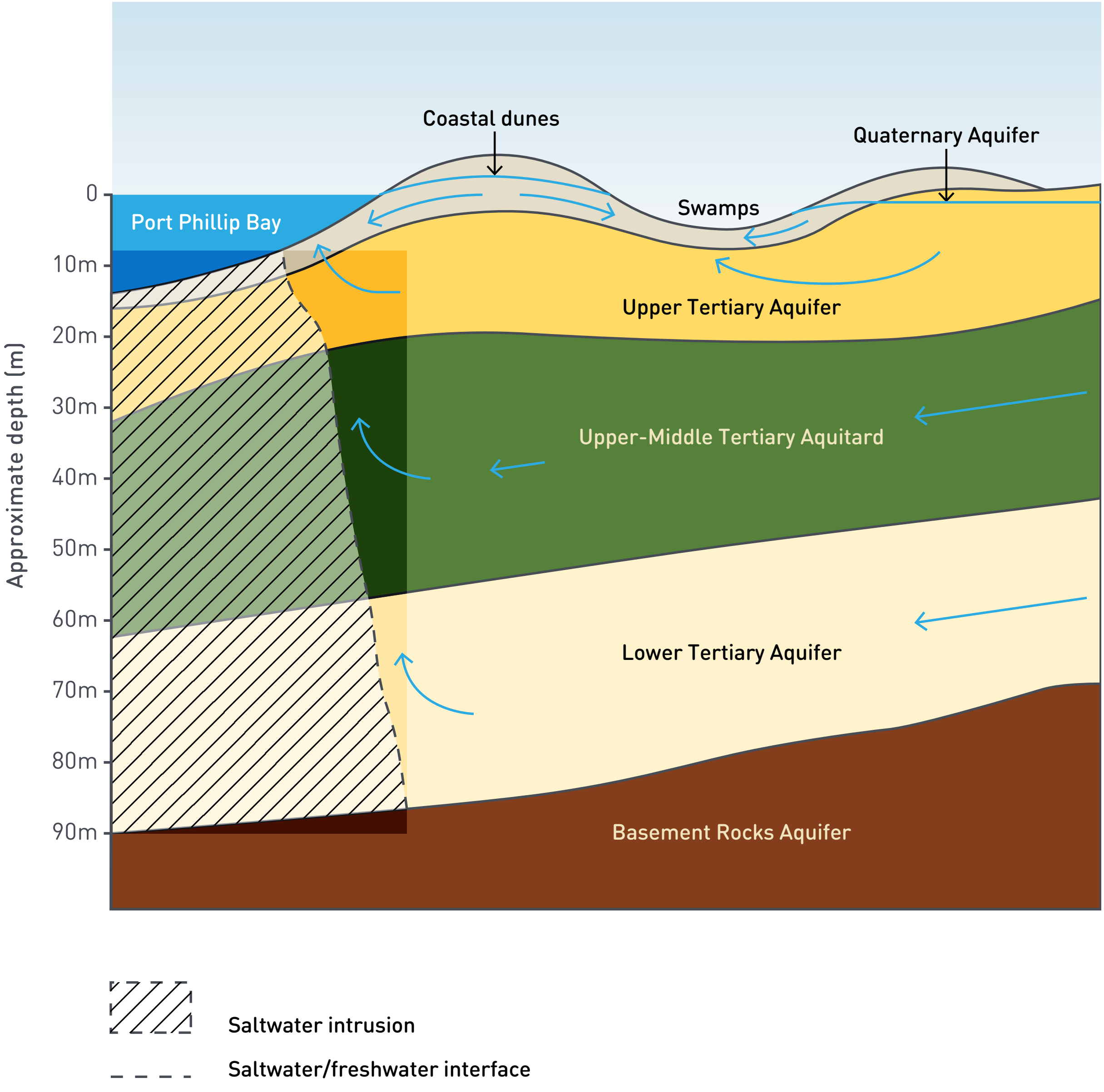
Seawater is denser and heavier than fresh water and naturally forms a saltwater wedge, shown in Figure 5.5, by the subsurface interface. The wedge can extend a few kilometres inland under the coastline into fresher quality aquifers. Under stable natural conditions, this saltwater wedge is natural and not a concern.

Changes to the location of the saltwater wedge can occur due to onshore activities that affect groundwater. For example, groundwater pumping or deep subsurface excavations could draw in groundwater from coastal aquifers and resultantly draw in seawater further inland, where it could increase the salinity of fresher quality aquifers.

In the context of the projects, the potential for saltwater intrusion exists due to installation of permanent 'pile walls'. These subsurface structures would cause a reduction in groundwater throughflow across the rail trench, resulting in groundwater drawdown on the coastal side of the rail trench. Groundwater drawdown could trigger the upwards movement of deeper saline groundwater. This effect is called saltwater intrusion (refer to Figure 5.5).

The outputs of the numerical saltwater intrusion model were used to improve the approximation of the shape and distance of the potential saltwater wedge intrusion on-shore, as well as actual temporal flow and salinity changes at the coast, as a result of the projects.

Figure 5.5 Conceptualising saltwater intrusion at the study area



5.3 Existing conditions

5.3.1 Edithvale-Seaford Wetlands

The Edithvale-Seaford Wetlands are the last few remnants of the once extensive Carrum-Carrum Swamp that originally extended between Mordialloc and Frankston, at the time of the first European Settlement in the area.

The Carrum-Carrum Swamp historically occupied an area of 5,360 hectares and was fed by waters from the Dandenong Creek, Eumemmerring Creek, the Mordialloc Creek and the Boggy Creek catchments. Many of these wetlands and associated drainage lines have been modified or developed to alleviate historic water logging. That is, the Edithvale-Seaford Wetlands are now hydrologically engineered features, which perform entirely different hydrologic functions compared to the natural setting. The Edithvale-Seaford Wetlands are now separated by Patterson River and the combined sites are declared Wetlands of International Importance under the Ramsar Convention protocol. In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use. Wise use under the Convention is broadly defined as maintaining the ecological character of a wetland.

While the Ramsar listing of the wetlands is a combined listing, the Seaford Wetland and Edithvale Wetland are hydraulically separate features, with the Patterson River forming a hydraulic divide. While the Seaford Wetlands is also part of the Edithvale-Seaford Wetlands Ramsar site, it is not considered further in this EES due to the hydraulic disconnection and limited potential for impacts as a result of the projects construction or operation – therefore the EES uses the term 'Edithvale Wetland', rather than the Edithvale-Seaford Wetlands, unless reference is being made

to the formal name of the wetland complex. It should be noted that no portion of the Edithvale-Seaford Wetlands occurs within the project areas.

Edithvale Wetland configuration

The Edithvale Wetland contains diverse habitat including shallow freshwater marsh, permanent open freshwater wetlands and brackish to saline ponds. At its closest point, Edithvale Wetland is situated approximately one kilometre east of the Edithvale project area and 1.5 kilometres northeast of the Bonbeach project area. Edithvale Road divides Edithvale Wetland into northern and southern sections.

Edithvale Wetland comprises numerous interconnected water bodies (wetland cells) of varying size and depth. The interconnections between the cells are important in controlling the movement of water from the eastern cells that receive surface water inflows and the western cells that discharge to the Centre Main Drain.

Figure 5.6 provides a plan of the surface water catchment that drains into the different components of Edithvale Wetland. Figure 5.6 shows that the surface water catchment extends from the high point of the coastal dune in the west, to the Mornington Peninsula Freeway (M11) in the east. The western portion of the catchment drains to Centre Main Drain, while the eastern portion drains to specific cells within Edithvale Wetland. Edithvale Wetland receives most of its water from runoff obtained from a highly urbanised catchment.

Figure 5.6 Edithvale Wetland surface water catchment

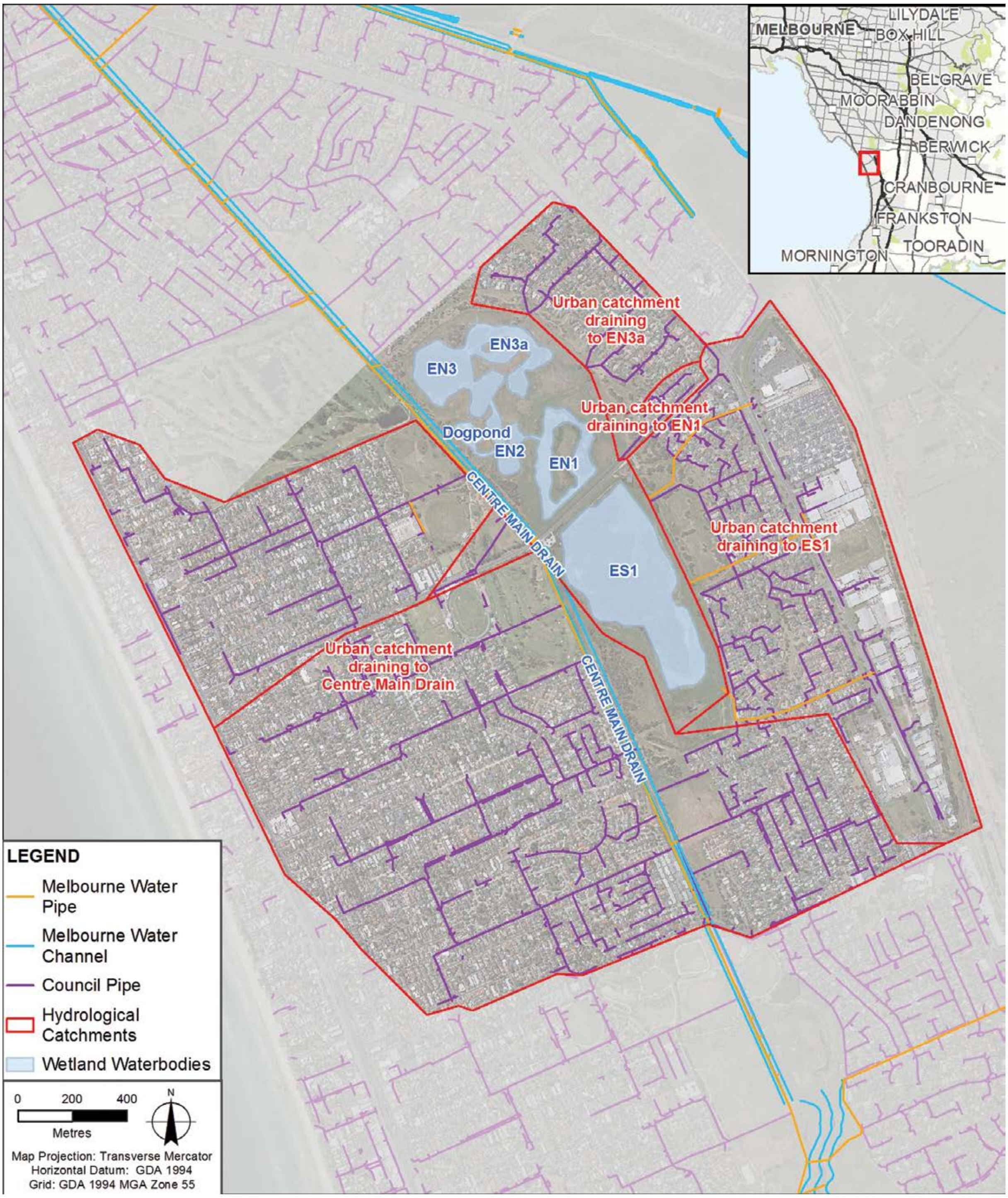


Figure 5.7 provides a conceptual cross section of Edithvale Wetland, specifically highlighting the interaction between individual wetland cells. The wetland cells are described below.

Southern portion of Edithvale Wetland

The southern section of the Edithvale Wetland comprises one wetland cell (ES1), which includes sections of variably shallow fresh to brackish swamp. The natural landform of the southern wetland was excavated to a very shallow depth in 1987, thus altering the natural hydrology and surface water quality to one that is fresh to brackish. It is unlikely that these excavations penetrated beyond the surficial soil layer. The southern portion of Edithvale Wetland lies at higher elevation compared with the northern wetland component, and thus drains into the northern portion of Edithvale Wetland via a drainage pipe beneath Edithvale Road.

Northern portion of Edithvale Wetland

The northern section of the wetlands comprises a series of constructed wetland cells (EN1, EN2, EN3 and the Dog Pond) that all function differently. Stormwater drains enter the wetlands via litter traps and sediment ponds at EN3. Similar to ES1, wetland cell EN1 comprises sections of variably shallow fresh to brackish swamp. EN2 includes deeper excavations that are unlikely to have penetrated the underlying clay layer or subsequent underlying aquifers.

The base of the two northern-most ponds (EN3 and EN3a) were excavated through an underlying clay layer and into the subsequent underlying sand material (potentially sediments of the Brighton Group Formation, which represents the Upper Tertiary Aquifer), resulting in a permanent connection between shallow groundwater and surface water at these locations. The excavations altered the natural hydrology, surface water quality and local groundwater flow regime to one that is brackish to saline.

One additional cell (Dog Pond) is located north of EN2 and receives overflow water from that cell. Two additional wetland cells (EC1 and EC2) are located in the northern section of the wetlands, to the west of Centre Main Drain. These cells are situated outside of the Ramsar boundary.

Centre Main Drain

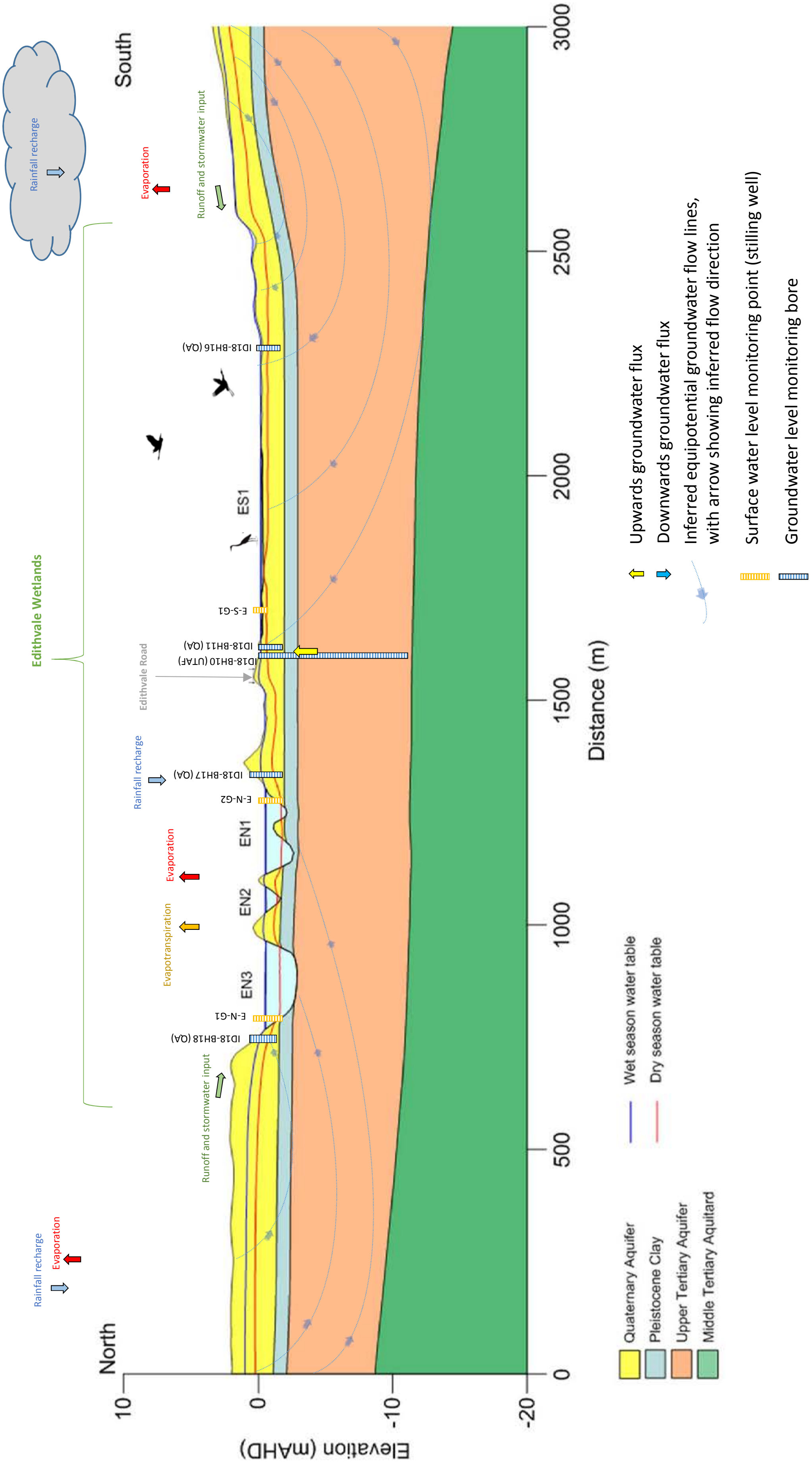
Centre Main Drain is a seven kilometre long retarding basin, extending from Patterson River in the south to Mordialloc Creek in the north. There is a pump station at both the northern and southern outlets of Centre Main Drain.

Centre Main Drain is the principal means of discharge for the wetland during wet periods. Centre Main Drain is orientated approximately north-south along the western boundary of Edithvale Wetland.

The primary connection between the wetland and the drain occurs at wetland cell EN3 to the north west of the complex. There are two PVC pipes linking the wetland to the drain and during very wet periods, cell EN3 can spill overland to the drain.

At Edithvale Wetland and north of Thames Promenade, Chelsea Heights, Centre Main Drain flows northerly towards Port Phillip Bay via Mordialloc Creek.

Figure 5.7 Edithvale Wetland conceptual cross section



5.3.2 Aquifers

Based on the geology and likely depth of the trenches, three main hydrogeological units (aquifers/aquitards) have been identified within the study area (refer to Figure 5.7):

- **Quaternary Aquifer** – occurs at depths of 0.3 to 5 metres below ground level at Edithvale and 0.1 to 8.2 metres below ground level at Bonbeach
- **Upper Tertiary Aquifer** – occurs at depths of 9.6 to 17 metres below ground level at Edithvale and 3.5 to 14 metres below ground level at Bonbeach
- **Upper – Middle Tertiary Aquitard** – occurs at depths of 22.3 to 33.5 metres below ground level at Edithvale and 30 to 38.4 metres below ground level at Bonbeach.

5.3.3 Groundwater levels

Groundwater levels can be referenced either as 'groundwater elevations' (measured to metres above the Australian Height Datum, AHD) or as 'depth to groundwater' (measured to metres below ground level, bgl). These levels vary depending on aquifer and geomorphic setting.

At the Edithvale Wetland, the Quaternary Aquifer and Upper Tertiary Aquifer show groundwater elevations *below* sea level (-0.5 mAHD), which given the low topography at the wetlands, equates to depths to groundwater as shallow as 0.2 metres below ground level and as deep as 1.2 metres below ground level.

Within the project areas at Edithvale and Bonbeach, the Quaternary Aquifer and Upper Tertiary Aquifer show shallow groundwater elevations *above* sea level (<1.3 mAHD), which equate to depths to groundwater as shallow as 0.8 metres below ground level and as deep as 5.9 metres below ground level.

Given the study area was historically part of a regional swamp, shallow groundwater levels do occur naturally. East of the coastal sand dune at Edithvale, the water table can be close to or at the ground surface during wet climatic periods, typically for short time periods. An example of this is the flooding of Edithvale Road, Edithvale following the 4 February 2011 storm event, which closed Edithvale Road to through-traffic for 11 days.

5.3.4 Groundwater flow

Regional groundwater flow

Based on the regional groundwater monitoring bore network installed between Cheltenham and Frankston, along with available data from regional State Observation Bore Network, the regional groundwater flow direction is inferred to be west to south-westerly at Edithvale, based on July 2017 monitoring data.

The east to west transect of monitoring bores at Bonbeach and Edithvale indicate a decline in groundwater levels towards Port Phillip Bay, consistent with the regional groundwater flow regime, which indicates discharge towards Port Phillip Bay.

Local groundwater flow

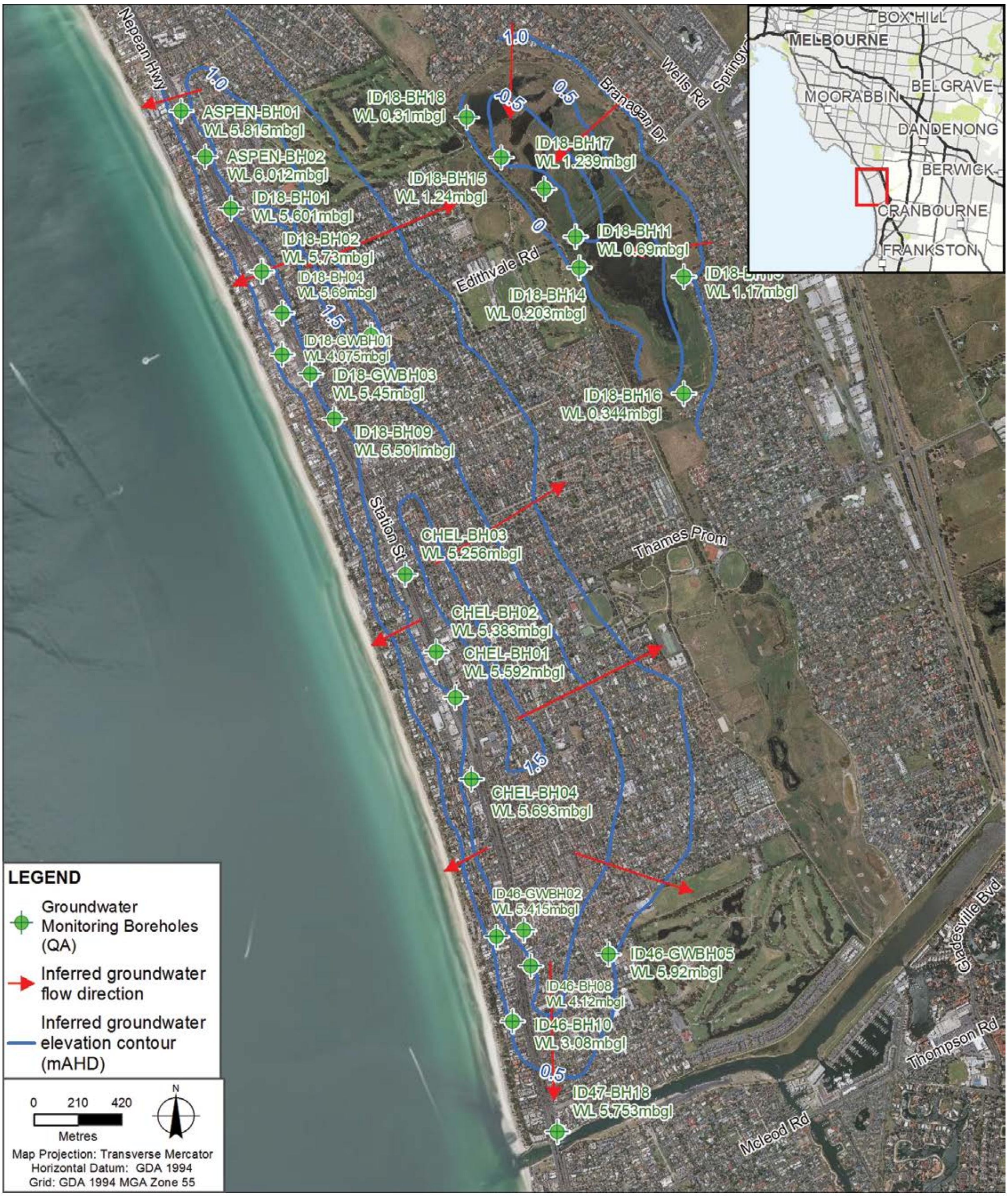
The local groundwater flow regime at the project areas is influenced by the surface topography which include a coastal dunes network which forms a local 'flow divide'. Local groundwater flows in different directions on each side of the flow divide, while overall, the regional groundwater flow direction is towards the coast (refer Figure 5.8). The railway has been constructed generally along the top of this dune network. To the east of the flow divide created by the dune network, local groundwater tends to flow in an easterly direction inland. To the west of the dunes local groundwater tends to flow west toward Port Phillip bay. At Bonbeach, the local groundwater flows in a generally south to south westerly direction towards Port Phillip Bay and Patterson River. While groundwater flow predominately occurs towards the bay, consistent with the regional flow regime, local variations in ground surface topography result in local changes to groundwater flow. The most notable aspect of the local flow regime is the easterly flow of shallow groundwater from the coastal dune inland.

Similarly, the groundwater monitoring bores to the south of Patterson River locally indicate a northward shallow groundwater flow towards the river. Patterson River therefore acts as a groundwater discharge feature as described previously, separating groundwater flow to the north of the river from that to the south.

Groundwater level measurements collected in August 2017 at Edithvale Wetland indicate that the hydraulic gradient at the wetland is relatively flat. Groundwater marginally flows towards the topographic low point of the wetlands – Centre Main Drain.

Centre Main Drain is aligned along the western boundary of the wetland and given its depth with respect to shallow groundwater, likely receives seasonal groundwater discharges.

Figure 5.8 Local groundwater flow regime (indicated by red arrows)



5.3.5 Groundwater flow rate

The rate that groundwater can flow is controlled by its permeability (hydraulic conductivity), which is a measure of how easily water can move through porous spaces and fractures in soil or rock.

At Edithvale, the average permeability within the Quaternary Aquifer is three metres per day and 0.8 metres per day within the Upper Tertiary Aquifer.

At Bonbeach, the average permeability within the Quaternary Aquifer is 0.3 metres per day and 0.07 metres per day within the Upper Tertiary Aquifer.

5.3.6 Groundwater recharge and discharge

Across the study area, groundwater recharge is primarily via rainfall, particularly in the sandy coastal dune sediments of the Quaternary Aquifer. Leakage of surface water from the Edithvale Wetland into the Quaternary Aquifer may also be a local recharge source for this aquifer. The concepts of groundwater recharge and discharge are broadly illustrated in Figure 5.1 and conceptualised specifically for Edithvale Wetland in Figure 5.7. Land uses such as residential, commercial or industrial uses act to reduce the amount of permeable ground surface area potentially available for groundwater recharge. While this should not be discounted, available groundwater level data indicates that groundwater recharge in response to significant rainfall events, does occur across the study area.

At some locations, deeper groundwater within the Upper Tertiary Aquifer discharges to the overlying Quaternary Aquifer, representing a groundwater recharge source for the shallow Quaternary Aquifer.

The regional groundwater regime includes discharge across the study area, for all aquifers, to Port Phillip Bay. Local flow regimes also occur, such as towards Patterson River in Bonbeach, and locally towards Edithvale Wetland in the shallow Quaternary Aquifer and Upper Tertiary Aquifer, in areas situated east of the coastal dune system.

In the context of the projects, there is more potential for the project to impact upon local groundwater flow regimes, based on the likely depths that the pile walls would be installed, as described in Section 5.1.2.

5.3.7 Groundwater quality

The *Environment Protection Act 1970* (EP Act) sets out the legislative framework to protect the environment in Victoria. The EP Act introduced the term 'beneficial use', which relates to a use of the environment or any element or segment of the environment where it is conducive to public benefit, welfare, safety, health or aesthetic enjoyment. Beneficial uses as they relate to groundwater require protection from the effects of waste discharges, emissions or deposits.

State Environment Protection Policies (SEPPs) are instruments created under the EP Act that set out more detailed requirements and guidelines to protect environmental values and human activities (beneficial uses) from the effects of pollution, waste and environmental degradation.

State Environment Protection Policy (Groundwaters of Victoria) 1997 provides a framework for the protection of groundwater, as well as the clean-up and management of polluted groundwater throughout Victoria. The policy defines the beneficial uses to be protected based on the quality of the groundwater in the area, measured as Total Dissolved Solids (TDS) and through the designation of 'beneficial uses'. SEPP (Groundwaters of Victoria) adopts TDS as the most appropriate groundwater quality indicator to define 'segments' of the groundwater environment, as it represents a highly variable physical parameter that can be measured in all groundwater and is the most common determinant of uses of groundwater. There are five groundwater segments (A1, A2, B, C and D) defined in the SEPP (Groundwaters of Victoria) based on groundwater salinity. The segment of groundwater determines the beneficial uses to be protected. The gradation between segments is outlined in Table 5.2.

The quality of groundwater at the Edithvale Wetland in the Quaternary Aquifer ranges from brackish (Segment B) to saline (Segment D). Elsewhere in Edithvale and at Bonbeach, the Quaternary Aquifer shows fresh groundwater quality, ranging from Segment A1 to A2. Each of these segments include potable water supply as a beneficial use. The underlying Upper Tertiary Aquifer however, shows more variable groundwater quality, ranging from 360 mg/L TDS (Segment A1) to 4,700 mg/L TDS (Segment C) at Bonbeach. As a conservative approach, the water table aquifer within the project areas is classified as Segment A1 for this assessment and identifying beneficial uses of groundwater to be protected.

In accordance with SEPP (Groundwaters of Victoria), the beneficial uses requiring protection for groundwater of this quality are outlined in Table 5.2. The relevance of some beneficial uses that are protected under Segment A1 in the project areas is questionable, including:

- **Potable water supply** – the relevance of potable water supply as a beneficial use in the project areas is questionable since the area is highly urbanised, expected bore yields are low and there are reticulated water supplies in place
- **Potable mineral water supply** – there are no known mineral or spring groundwater sources in the study area
- **Industrial water use** – expected bore yields are too low to maintain the high yields required for commercial/industrial purposes.

Table 5.2 Protected beneficial uses of groundwater segments

Beneficial use	Segments (mg/L TDS)				
	A1 (0-500)	A2 (501 -1,000)	B (1,001 -3,500)	C (3,501 -13,000)	D (> 13,000)
Maintenance of ecosystems Groundwater must be of a certain quality to maintain ecosystems in surface water bodies such as the Edithvale Wetland and Patterson River	✓	✓	✓	✓	✓
Potable water supply Groundwater must be safe to drink or to use for food preparation					
Desirable	✓				
Acceptable		✓			
Potable mineral water supply	✓	✓	✓		
Agriculture, parks and gardens Groundwater of this quality must be suitable for watering crops or for irrigating public parks and gardens	✓	✓	✓		
Stock watering Groundwater must be of an acceptable quality to be used as a drinking water supply for livestock	✓	✓	✓		
Industrial water use Groundwater of this quality must be suitable for industrial processes, including general use such as washing down equipment, vehicles or work areas	✓	✓	✓	✓	
Primary contact recreation Groundwater must be suitable for a surface water body in which people swim or to fill a swimming pool	✓	✓	✓	✓	
Buildings and structures Subsurface structures such as building foundations that are in contact with groundwater must be protected from contamination that may cause degradation or corrosion of those structures	✓	✓	✓	✓	✓

5.4 Model results

The proposed rail trenches would extend below the ground surface and at some locations, below the water table. The pile walls required for the rail trenches, described in Chapter 2 *Rationale and project descriptions,* would create an obstruction to the existing groundwater flow regime, which is understood to include westerly flow towards the coast at Edithvale and south-westerly flow towards the coast and Patterson River at Bonbeach.

The predictive modelling described in Section 5.2.3 was used to quantify the potential impacts of pile walls on groundwater at the Edithvale and Bonbeach level crossing removal sites. As described in the methodology (see Section 5.2.3), to understand the effect of the trenches on groundwater levels the model incorporated 20 years of data collected from an existing network of regional groundwater monitoring bores, as well as data collected from 121 bores installed more recently along the Frankston rail corridor and locally within the Edithvale Wetland. The model, once calibrated (i.e. running and correcting parameters within the model to align predicted outputs with observed data), was run nearly 200 times to predict the magnitude and extent of changes in groundwater levels.

Groundwater level changes were predicted by the model to occur locally as a result of the pile walls at Edithvale and Bonbeach. These predicted groundwater level changes are represented by either:

- groundwater mounding (predicted to occur on the inland side of the pile walls)
- groundwater drawdown (predicted to occur on the coastal side of the pile walls).

The amount and extent of both groundwater mounding and drawdown are highly sensitive to the climatic condition at a given point in time. The outputs of the model discussed below are presented as model year 5 and year 12, which represent historic wet (model year 5, 2002) and historic dry (model year 12, 2009) years within the model simulation period. As documented in the Groundwater Modelling Technical Report, included in Technical Report A *Groundwater*, model year 5 represents a period when the water table was locally elevated by higher than average recharge, with a greater volume of groundwater throughflow towards the coast compared to drier years. Conversely in model year 12, there is less recharge and less groundwater throughflow, resulting in less mounding of groundwater on the up gradient (inland) side of the pile walls.

In assessing the potential changes to groundwater flow regimes, model year 5 represents the most conservative output as it is the year of greatest predicted impact. For this reason, model year 5 is used as the basis of the assessments within this EES.

5.4.1 Edithvale

At Edithvale, the pile wall would be constructed west of the local 'flow divide' created by the dune network. Therefore, local groundwater flow from the flow divide occurs in both an easterly direction inland, and in a westerly direction towards the coast. Since the overall regional groundwater flow is towards the coast, the pile wall could cause groundwater mounding on the eastern side (inland) of the pile wall and as a result drawdown on the western side (coastal) of the pile wall. Figure 5.9 provides a cross section illustrating the predicted changes in groundwater levels at Edithvale in model year 5 and model year 12, both with the project (with pile walls) and without the project (without pile walls) based on the initial assessment. As discussed previously, Figure 5.9 demonstrates the model predictions of greater mounding during wet climatic periods (model year 5). Since the study area are topographically flat, vertical exaggeration has been applied (vertically exaggerated by 30 times) to Figure 5.9 to demonstrate the subtle changes in groundwater levels predicted with the project in place.

Figure 5.10 shows a plan view of the predicted area of groundwater impact during model year 5. The predicted groundwater level changes are represented by either:

- groundwater mounding (shown as negative values to represent an increase in groundwater levels on the inland side of the trench)
- groundwater drawdown (shown as positive values to represent a decrease in groundwater levels on the coastal side of the trench).

Figure 5.10 demonstrates that during model year 5, groundwater mounding is predicted to result in an increase in groundwater levels of up to 0.9 metres within 50 metres of the rail trench. Groundwater drawdown is predicted to result in decreases in groundwater levels of up to 1.4 metres within 50 metres of the rail trench.

Figure 5.9 Predicated groundwater level changes at Edithvale (west to east)

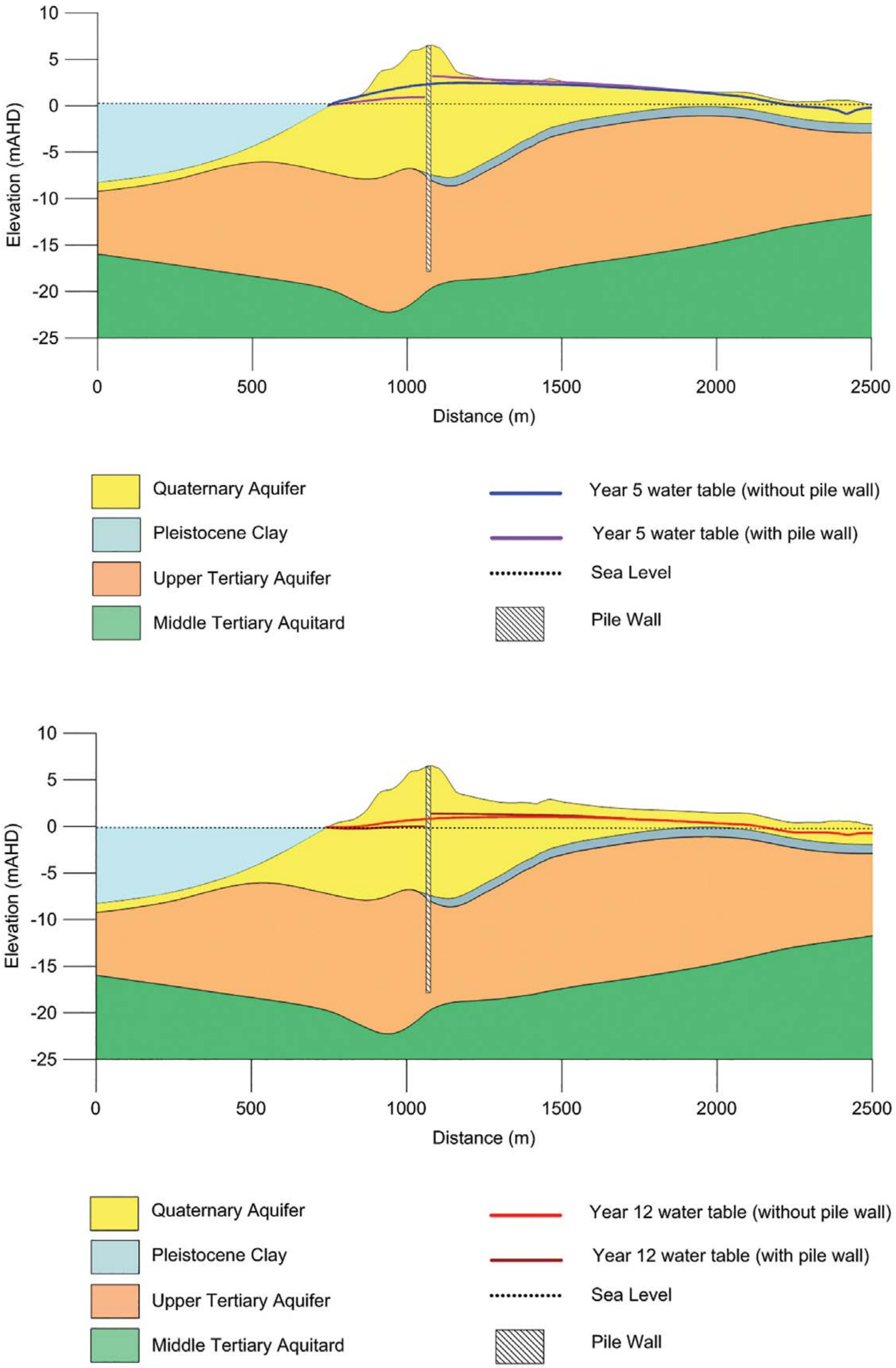


Figure 5.10 Predicted area of groundwater mounding and drawdown at Edithvale based on the initial assessment

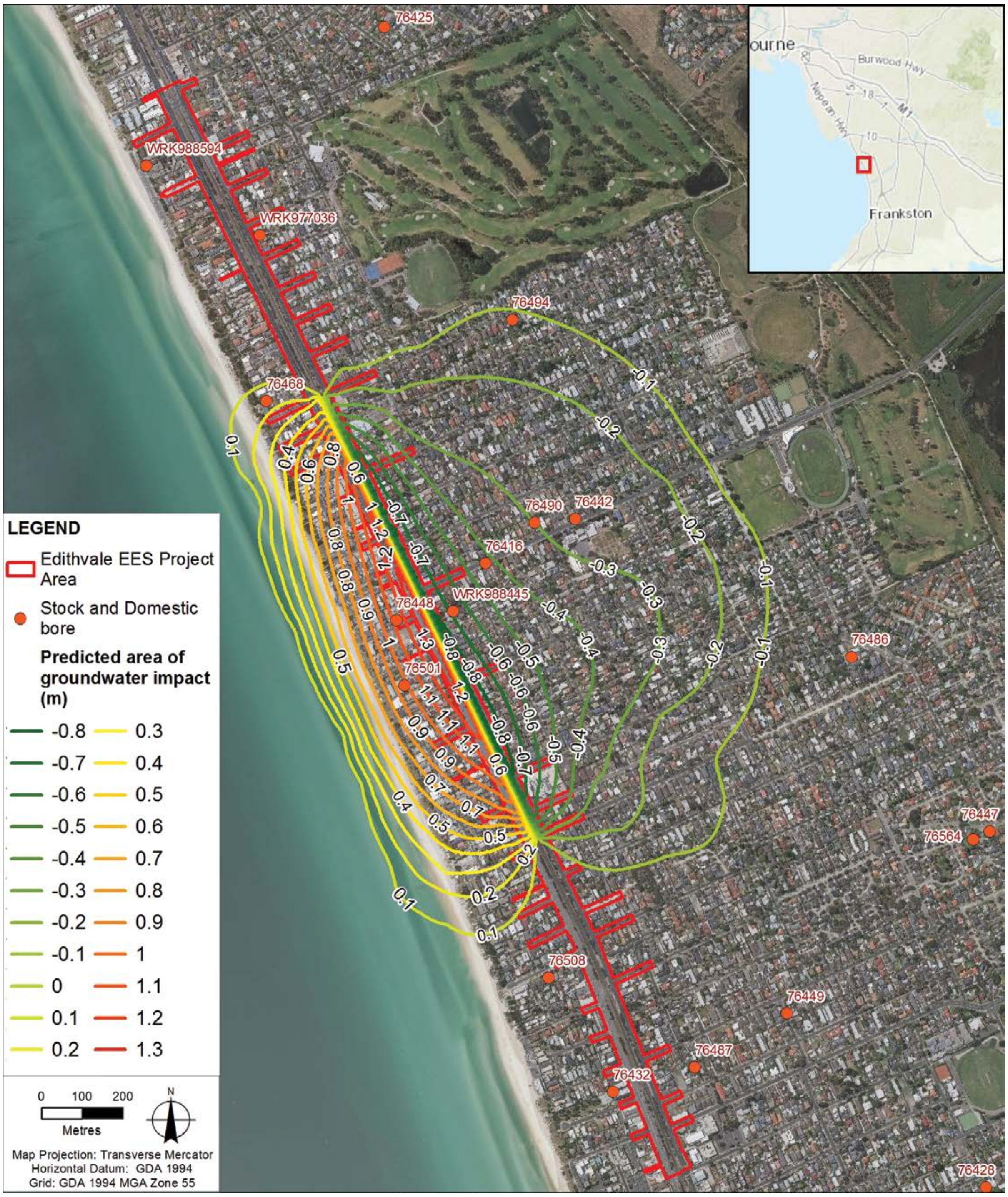


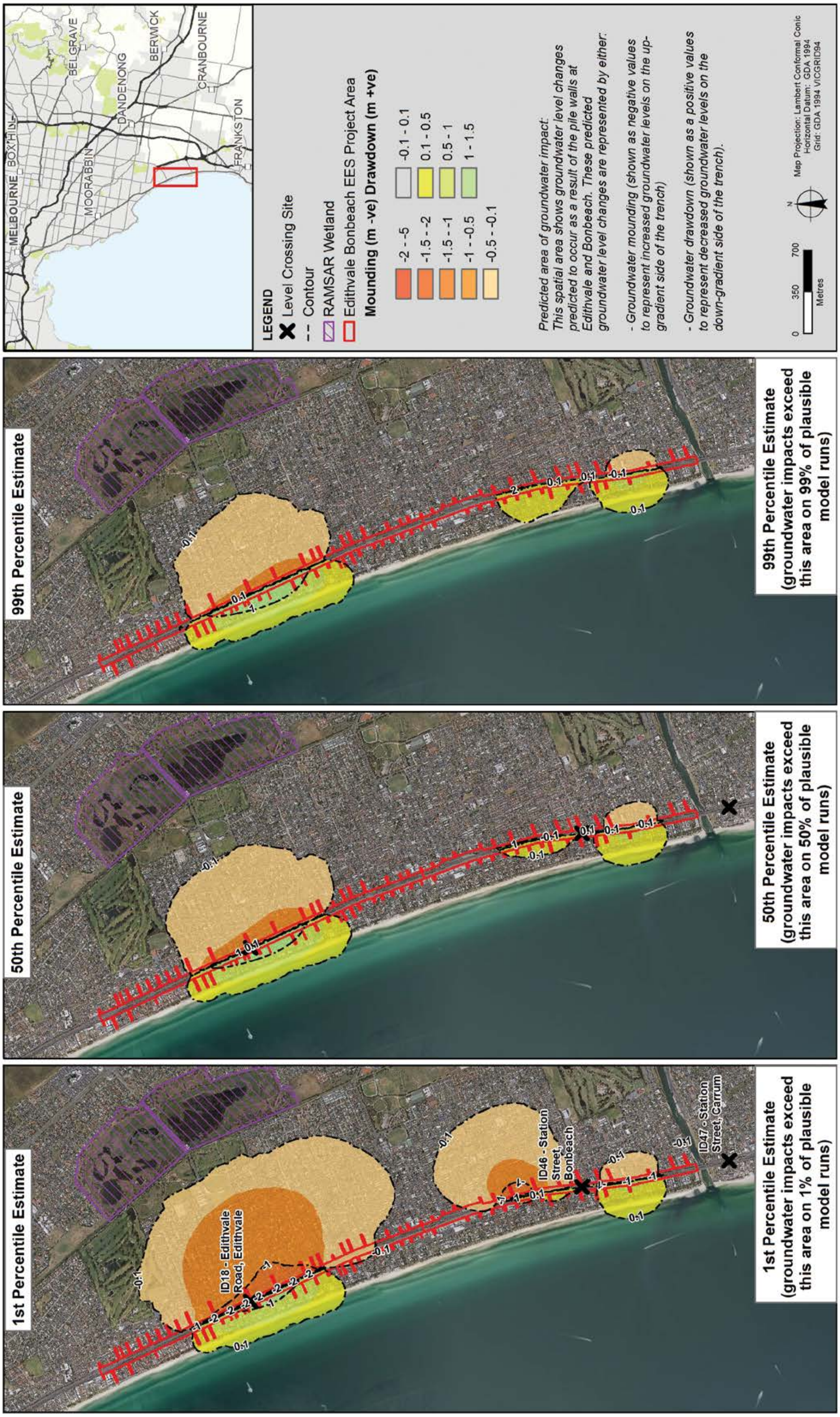
Figure 5.11 shows that for the period of greatest modelled impact (model year 5), groundwater drawdown and mounding impacts that are greater than 0.1 metres do not intersect Edithvale Wetland. The 0.1 metre contour has been adopted as the minimum contour for defining the extent of predicted area of groundwater impact.

Because model parameters are uncertain, with a plausible range of values, the same ratio of parameters may be obtained with different combinations of parameter values, resulting in more than one plausible realisation of the same model. Confidence limits associated with the model output represent the degree of certainty in the results. After running the model 196 times, a statistical analysis of the results provided an indication of the proportion of outputs that produce a particular result.

For example, the 1st percentile confidence limit represented the level of impact exceeded in only one per cent of model runs. In other words, most of the model runs (99 per cent of them) predict effects on groundwater that are equal to or less than the impact shown in the left-hand pane of Figure 5.11. This indicates that the area of groundwater mounding that is predicted to occur in 99 per cent of the models does not intersect Edithvale Wetland. The 0.1 metre contour occurs as close as 250 metres to the Edithvale Wetland, 99 per cent of the time.

Conversely, very few of the model runs (one per cent of them) resulted in predicted impacts to groundwater that are less than shown in the right-hand pane of Figure 5.11 (the 99th percentile confidence limit). The 1st and 99th percentile estimates were used to present the most and least impacted cases, respectively, based on the initial assessment. The 50th percentile shows the model predictions for which half the model runs produce impacts less than that shown.

Figure 5.11 Modelled water table changes and uncertainty analysis at Edithvale and Bonbeach



Predicted area of groundwater impact:
This spatial area shows groundwater level changes predicted to occur as a result of the pile walls at Edithvale and Bonbeach. These predicted groundwater level changes are represented by either:

- Groundwater mounding (shown as negative values to represent increased groundwater levels on the up-gradient side of the trench)

- Groundwater drawdown (shown as a positive values to represent decreased groundwater levels on the down-gradient side of the trench).

99th Percentile Estimate (groundwater impacts exceed this area on 99% of plausible model runs)

50th Percentile Estimate (groundwater impacts exceed this area on 50% of plausible model runs)

1st Percentile Estimate (groundwater impacts exceed this area on 1% of plausible model runs)

Groundwater management

The low-lying nature of the Edithvale project area means that it is prone to naturally shallow groundwater levels, with potential for groundwater levels to reach the ground surface during wet climatic periods. This process occurs periodically under existing conditions at Edithvale and is referred to as 'water logging'.

Through the risk and impact assessment process (discussed in Section 5.6), it was identified that the pile wall configurations outlined in Section 5.2.5 and described in Chapter 2 *Rationale and project descriptions* at Edithvale could result in additional water logging at Edithvale. For clarity, it should be noted that water logging is predicted to occur at Edithvale if the project is not built, but that the proposed pile walls could result in an increase in the frequency that water logging could occur at Edithvale. Water logging was not predicted to occur at Bonbeach, neither under existing conditions, nor as a result of the Bonbeach project.

To manage the risk of increased water logging associated with the pile walls, an engineering solution which would improve the throughflow of groundwater around the pile walls compared to the predictions obtained from the initial assessment, was developed for the Edithvale level crossing removal project. A preliminary assessment of the engineering solution was undertaken and is presented in Appendix H of Technical Report A *Groundwater*. The assessment outlines:

- performance criteria that should be considered in the development of an engineering solution to manage groundwater during the detailed design at Edithvale
- an assessment of effectiveness of a potential engineering solution, in the context of minimising changes to groundwater levels caused by the project.

One example of a potential engineering solution that could enable the local groundwater regime to flow around the rail trench was identified and modelled to demonstrate its effectiveness. In considering a potential engineering solution, performance outcomes were developed to form a framework for development of technical designs. Ultimately, the solution would need to ensure that the difference in groundwater levels on either side of the trench would not result in:

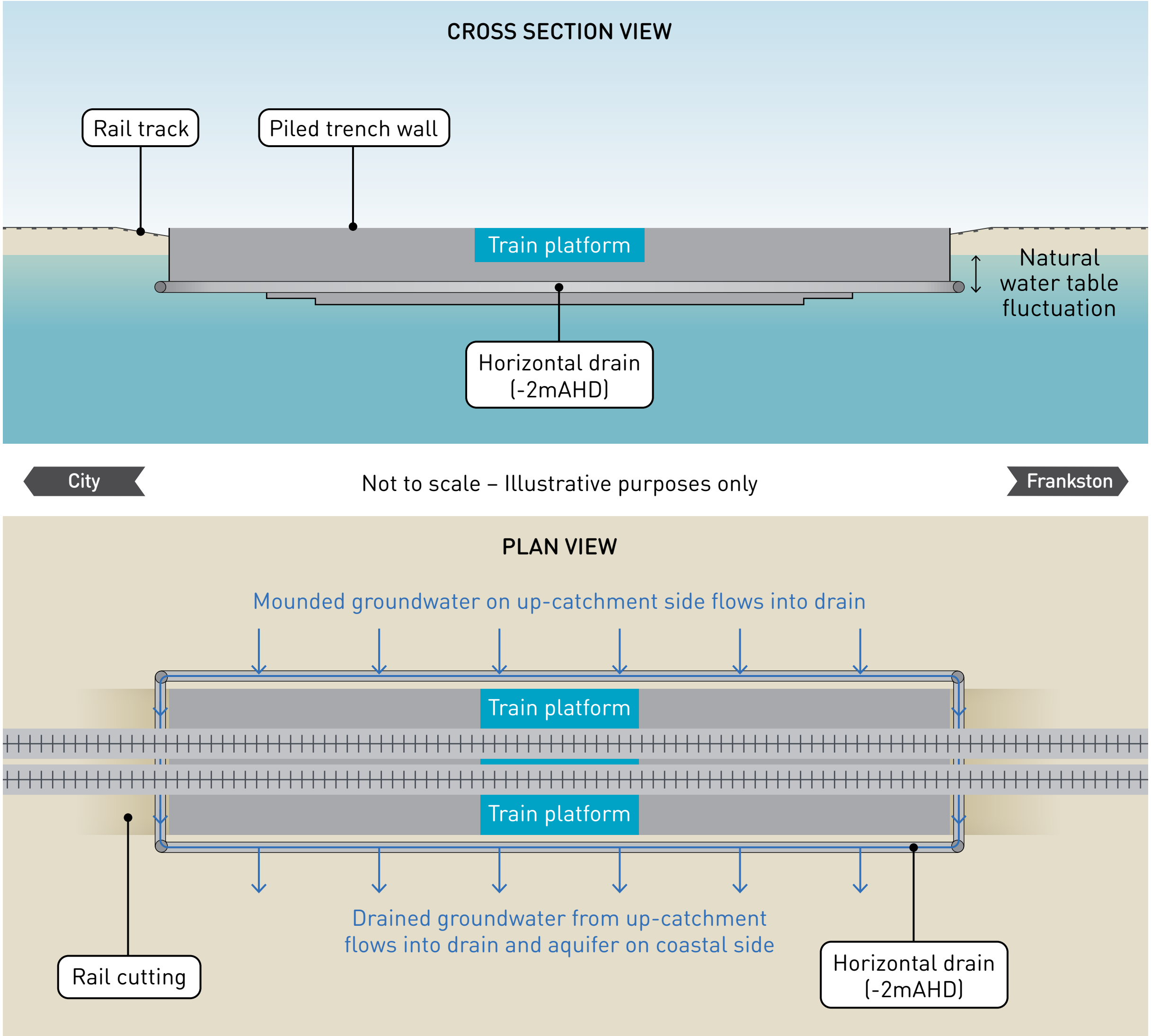
- groundwater mounding that increases water logging at ground level
- groundwater drawdown that could cause ground subsidence and adverse impact to subsurface structures
- degradation to groundwater quality that would preclude beneficial use of groundwater (salinity, contaminants, acid sulfate soils)
- changes to groundwater that would have significant impacts on GDEs.

The above performance criteria have been consolidated within performance requirement EPR_GW2 (refer Chapter 9 *Environmental Management Framework*), which the final constructed design must meet. The performance of the final constructed design would be monitored to confirm it is not having an impact on groundwater levels and quality beyond those set out in EPR_GW2. A Groundwater Management and Monitoring Plan would be developed for the project, to manage predicted and potential impacts to groundwater following construction of the pile walls (EPR reference GW3). The engineering solution developed for this EES demonstrates that EPR_GW2 could be achieved to mitigate the potential impacts predicted at Edithvale. The engineering solution is outlined below and discussed in Section 5.6.1. Prior to construction of the trench, an independent peer review would be undertaken by appropriately qualified specialists to confirm that the proposed engineering solution, or any variation or alternative to it, would achieve EPR_GW2 (EPR reference GW4).

The engineering solution modelled for this EES comprises the installation of a passive horizontal drain, which is an underground pipe that would be installed around the outside of, and adjacent to, the pile walls. The pipe would be installed at a depth that is permanently below the naturally variable water table, and perforated to allow groundwater inflow and outflow. The same numerical groundwater model developed in the initial assessment was used to model the engineering solution, based on the same 20-year model period.

Groundwater mounding and drawdown predicted in the initial assessment would be caused by the creation of a pressure difference either side of the trench. The passive horizontal drain would provide a permeable connection across the rail trench, reducing this potential pressure difference and minimising the difference in groundwater levels on either side of the trench. Figure 5.12 provides a schematic representation of the passive horizontal drain.

Figure 5.12 Schematic representation of the passive horizontal drain

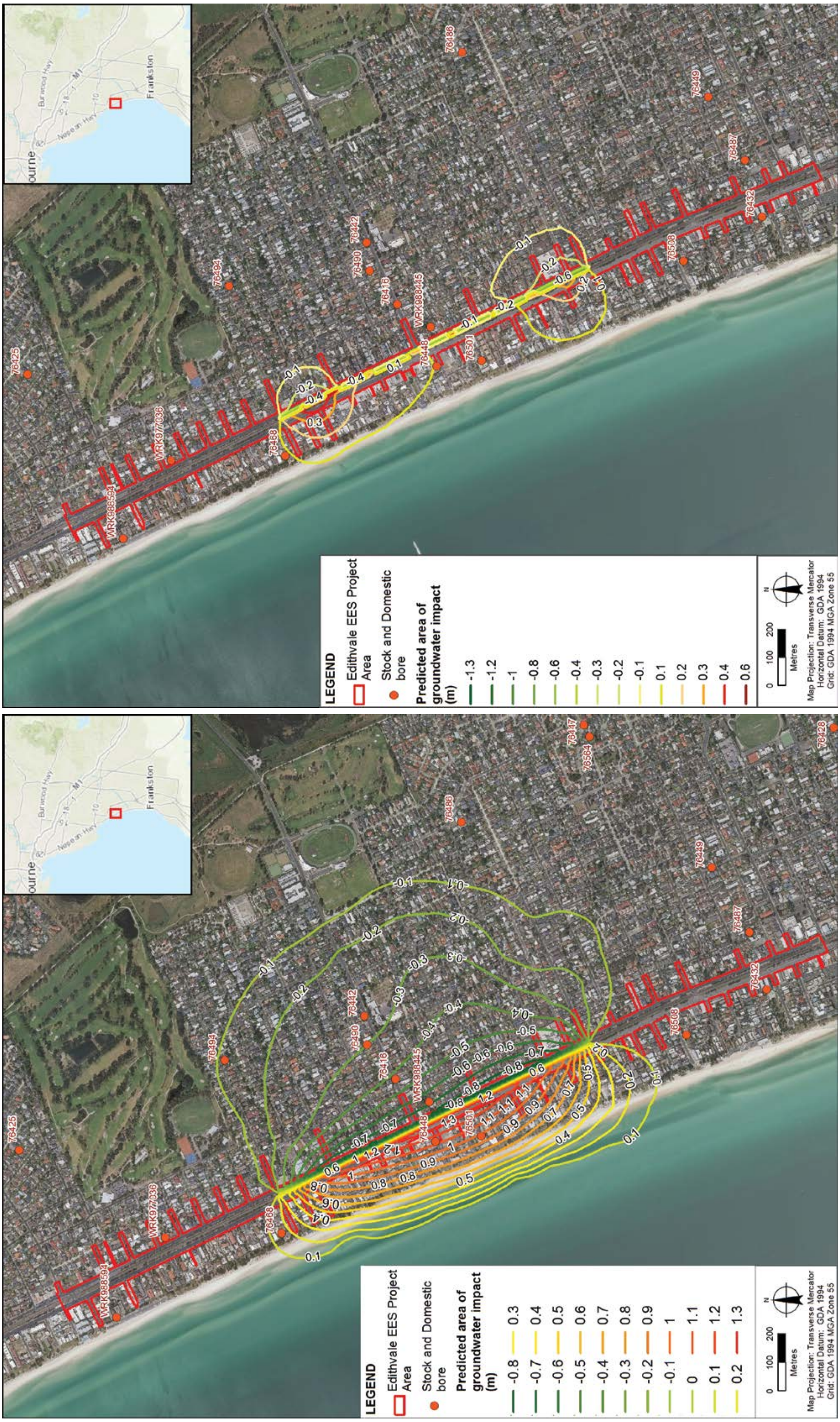

CROSS SECTION VIEW
Rail track
Piled trench wall
Train platform
Natural water table fluctuation
Horizontal drain (-2mAHD)
City
Not to scale – Illustrative purposes only
Frankston
PLAN VIEW
Mounded groundwater on up-catchment side flows into drain
Train platform
Train platform
Drained groundwater from up-catchment flows into drain and aquifer on coastal side
Rail cutting
Horizontal drain (-2mAHD)

A full description of the potential engineering solution, the groundwater modelling method and results and an assessment of effectiveness based on the 'mitigated assessment' are included in Appendix H of Technical Report A *Groundwater*.

Based on the mitigated assessment, the predicted groundwater level changes were less compared with the initial assessment at Edithvale. Figure 5.13 shows that at Edithvale, implementing the engineering solution could result in:

- **Groundwater mounding** (increase in groundwater level) of up to 0.2 metres within 50 metres of the rail trench, reducing to less than 0.1 meters within approximately 150 metres of the rail trench. As per the initial assessment, the mitigated assessment does not show predicted changes to groundwater level that extend to the Edithvale Wetland.
- **Groundwater drawdown** (decrease in groundwater level) of up to 0.3 metres within 50 metres of the rail trench, reducing to 0.2 metres within approximately 100 metres of the rail trench, which does not extend to areas of coastal dune vegetation.

Figure 5.13 Predicted area of groundwater mounding and drawdown at Edithvale based on the initial assessment (left) and mitigated assessment (right)



5.4.2 Bonbeach

The initial assessment included groundwater modelling at Bonbeach, based on the pile walls of the trench described in Chapter 2 *Rationale and project descriptions.*

Based on the initial assessment at Bonbeach, groundwater mounding (increase in groundwater level) of up to 0.4 metres within 50 metres of the rail trench was predicted, along with groundwater drawdown (decrease in groundwater level) of up to 0.7 metres within 50 metres of the rail trench.

The groundwater mounding and drawdown predicted through the initial assessment at Bonbeach was significantly less in terms of magnitude and extent of potential impacts, when compared to the model predictions for Edithvale:

- The predicted increase in groundwater levels at Bonbeach (0.4 metres) was less than half of the predicted increase at Edithvale (0.9 metres). The predicted decrease in groundwater level at Bonbeach (0.7 metres) was also half of that predicted to occur at Edithvale based on the initial assessment (1.4 metres).
- The spatial area predicted to be impacted by groundwater level changes at Bonbeach was smaller compared to potential impacts predicted through the initial assessment at Edithvale, refer to Figure 5.14. Specifically:
  - mounding at Bonbeach is approximately ten times smaller than at Edithvale
  - drawdown at Bonbeach is approximately two times smaller than at Edithvale.

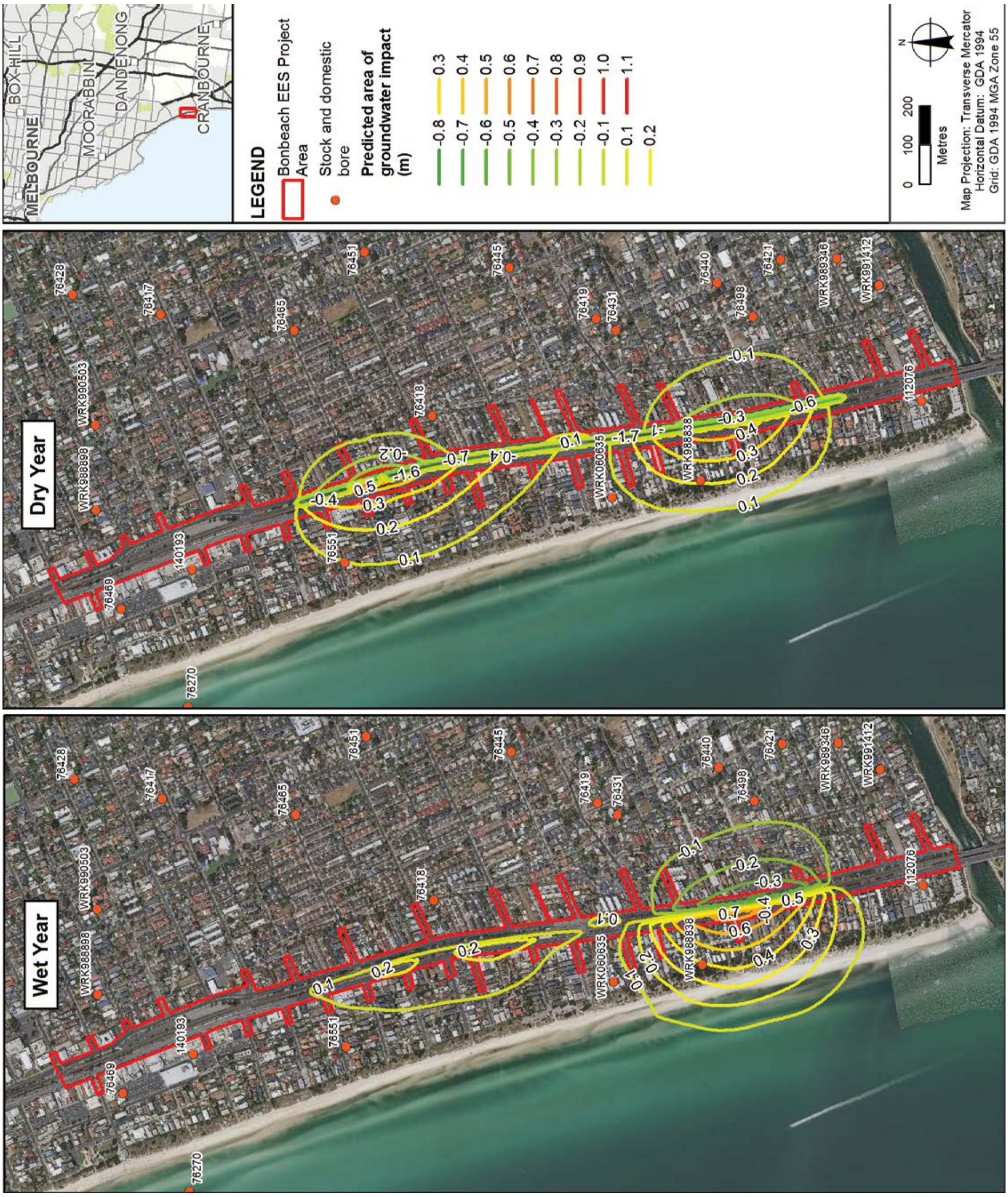
The reduced magnitude and extent of mounding and drawdown at Bonbeach is due to multiple factors, including:

- The difference in the local groundwater flow regime, which results in a groundwater flow direction that is perpendicular to the pile wall at the Edithvale level crossing removal site, resulting in greater impedance of groundwater throughflow. At the Bonbeach level crossing removal site, groundwater flow is locally towards the south, towards Patterson River. At areas where the flow line is parallel to the pile wall, less impedance on groundwater throughflow is predicted.
- The locations of the pile walls in relation to the location of local groundwater 'flow divides' at Edithvale and Bonbeach. The 'flow divide' separates westward groundwater flow (towards Port Phillip Bay) from eastward flow (towards Edithvale Wetland and Wannarkladdin Wetlands):
  - At Bonbeach, the pile wall would be constructed at the location of the 'flow divide' and would theoretically have limited effect on the water table at Bonbeach because it has limited opportunity to interrupt the lateral flow of groundwater across the rail trench.
  - At Edithvale, the pile wall would be constructed west of the 'flow divide'. Therefore, groundwater flow from the flow divide occurs both easterly towards Edithvale Wetland and westerly towards the coast. Since there is a component of groundwater flow towards the coast, the pile wall would theoretically cause groundwater mounding on the eastern side (inland) of the pile wall and resultant drawdown on the western side (coastal) of the pile wall.

The uncertainty analysis discussed in Section 5.4 indicates that at Bonbeach, potential groundwater mounding impacts predicted to occur through the initial assessment at Bonbeach, do not intersect Wannarkladdin Wetlands. The analysis indicates that 99 per cent of model runs predict the 0.1 metre contour to occur 400 metres from Wannarkladdin Wetlands (left pane in Figure 5.11).

A mitigated assessment was not undertaken for Bonbeach, since the risks identified through the initial assessment were considered sufficiently low, such that further mitigation beyond the project design would not be required. The pile wall configuration proposed includes measures that minimise potential impacts to groundwater, including stepped depths of impermeable piles. Refer to Chapter 2 *Rationale and project descriptions* for further information.

Figure 5.14 Predicted area of groundwater mounding and drawdown at Bonbeach based on the initial assessment



5.5 Construction impact assessment

An assessment of risks and impacts to groundwater posed by the projects was undertaken in accordance with the method described in Chapter 4 *Assessment framework*. One groundwater risk was identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects, which is outlined in Table 5.3 and discussed below.

The only risks pertaining to groundwater during construction could be caused by groundwater drawdown. Groundwater mounding is not anticipated to occur during construction, since there would not be a noticeable impedance of groundwater flow while the pile walls were being constructed.

Table 5.3 Groundwater risks – construction

Risk ID	Event name	Potential impact pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW58	Interference with users – Edithvale	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan EPR CL4 Acidic and/or contaminated groundwater (construction)	Negligible	As initial EPR	Negligible
GW65	Interference with users – Bonbeach	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan EPR CL4 Acidic and/or contaminated groundwater (construction)	Negligible	As initial EPR	Negligible

Groundwater drawdown during construction (risk GW58 and GW65)

During excavation of the trenches at Edithvale and Bonbeach, there is potential for groundwater inflow to the excavation and groundwater drawdown to occur. Since the pile walls would be constructed prior to the trench excavations, groundwater drawdown is expected to be limited to groundwater that occurs between the pile walls. The construction approach described in Chapter 2 *Rationale and project descriptions* would minimise interaction with groundwater that occurs beyond the pile walls.

To verify this, site investigations and a construction phase dewatering model were used to assess the potential impact to groundwater and existing groundwater users as a result of short term drawdown associated with construction dewatering. The model predicted that negligible groundwater drawdown would occur beyond the pile walls as a result of the construction phase, because excavations occur inside the impermeable trench. Groundwater dewatering, if required, would be limited to groundwater within the trench during construction.

The project description in Chapter 2 *Rationale and project descriptions* provides conservative design assumptions that have been used to assess impacts. Based on the project description, the trench could require up to 1,000 metres of trench excavation below the water table, which would result in a total groundwater discharge estimated to be up to 24 cubic metres per day, which is considered to be readily manageable.

As the groundwater drawdown outside the trench is predicted to be negligible at Edithvale and Bonbeach during the construction phase, associated impacts related to groundwater level changes are not anticipated during project construction. Specifically:

- interference with existing users of groundwater is not anticipated during project construction
- impacts to the beneficial use of groundwater are not anticipated during project construction
- induced migration of existing identified contamination plumes is not anticipated during project construction.

The risk of drawdown of groundwater levels on the down gradient side of the trench and impact on groundwater availability to existing or potential future users was assessed as negligible. The rail trenches would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). Collection, treatment, disposal and handling of seepage water that does enter the excavation would be carried out in accordance with the Construction Environmental Management Plan (CEMP), developed in accordance with EPA Victoria requirements (EPR reference CL4). Monitoring of groundwater levels and quality would be carried out in accordance with the Groundwater Management Plan (EPR reference GW3).

5.6 Operation impact assessment

5.6.1 Edithvale

An assessment of risks and impacts to groundwater posed by the projects was undertaken in accordance with the method described in Chapter 4 *Assessment framework*. An initial risk assessment was undertaken to assess potential risks to the environment arising from the implementation of the project at Edithvale. Through the risk and impact assessment process, a need to manage groundwater at Edithvale was identified to reduce the potential changes to groundwater levels caused by the pile walls and associated impacts.

To manage potential impacts predicted through the initial assessment, an EPR was developed which would reduce the magnitude and extent of project induced groundwater level changes at Edithvale. As outlined in Section 5.4, an engineering solution was developed and modelled to demonstrate that a mitigation measure could be adopted to minimise the impact of the project on groundwater levels to the extent that the performance outcomes in EPR_GW2 could be achieved. The risks were then reassessed to determine the residual project risk based on this additional performance requirement. The initial and residual groundwater risks identified for the operation phase of the Edithvale level crossing removal project are outlined in Table 5.4.

Risks associated with activation of acid sulfate soils as a result of groundwater drawdown (risk GW60) and contaminant migration as a result of groundwater mounding (risk GW62) are discussed in Chapter 6 *Acid sulfate soils and contamination*.

Table 5.4 Edithvale groundwater risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW58	Interference with users – Edithvale	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 – Rail trench design	Minor	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible
GW59	Subsidence – Edithvale	Drawdown on the down gradient side of trench could result in subsidence of unconsolidated subsurface sediments resulting in adverse impact to structures.	EPR GW1 – Rail trench design EPR GM1 – Pre-construction condition survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GM1 – Pre-construction condition survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Negligible
GW60	CASS activation – Edithvale	Drawdown on the down gradient side of trench and mounding on up-gradient side of trench could result in changes in groundwater levels, which could give rise to acidification of CASS and/or mobilise any existing acidity and groundwater acidification affecting beneficial uses of land and groundwater.	EPR GW1 – Rail trench design	Moderate	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR CL5 – Acidic and/or contaminated groundwater (operation)	Negligible

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW61	Water logging – Edithvale	Mounding on the up-gradient side of trench results in increasing the spatial area and duration that the subsurface experiences groundwater levels at or near the ground surface.	EPR GW1 – Rail trench design	Moderate	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible
GW62	Contaminant migration – Edithvale	Mounding on the up-gradient side of trench, drawdown on down gradient side of trench, and groundwater physically diverted either to the north or south along the up-gradient side of the trench could alter contamination plume migration adversely impacting on beneficial uses of land and groundwater.	EPR GW1 – Rail trench design	Moderate	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – Spoil Management Plan EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR CL5 – Acidic and/or contaminated groundwater (operation)	Minor
GW63	Foundations – Edithvale	Mounding on the up-gradient side of trench could result in increasing the spatial area and duration that existing subsurface foundations experience groundwater levels at or near the ground surface.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Minor	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW64	Saltwater intrusion – Edithvale	Drawdown on the down gradient side of trench could result in inland migration of the saltwater wedge and salinisation of aquifers, resulting in change in beneficial use of groundwater of land and groundwater.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Moderate	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plann	Negligible
EG72	Edithvale Wetland – Edithvale	Groundwater mounding leading to altered hydrological regime and/or water quality resulting in a change in ecological character (habitat and/or food availability) that exceeds the limit of acceptable change for critical components, processes and systems to the extent that the Edithvale-Seaford Wetlands no longer meet criteria for listing as a Ramsar site.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 – GDE Monitoring and Mitigation Plan (Edithvale Wetland)	Negligible

Interference with groundwater users (risk GW58)

During operation, predicted groundwater drawdown on the down-gradient side of the trench has the potential to impact the availability of groundwater for existing registered groundwater users. As defined in Section 5.1.3, existing groundwater users access groundwater either through licensed extraction bores or 'stock and domestic' bores.

All licensed groundwater extraction bores are situated beyond the predicted area of drawdown of the projects, therefore, the existing licensed groundwater extractions are not predicted to be impacted by the project.

Based on initial assessment and during the period of greatest modelled impact, there are three stock and domestic bores identified through the DELWP Water Measurement Information System and located within the predicted area of drawdown of the Edithvale level crossing removal project (refer to Figure 5.15). The initial assessment predictions for the period of greatest modelled impact (model year 5) suggest that:

- Bore 76,448 is inferred to be dry under existing conditions and would remain dry based on the predicted drawdown at this location
- the available drawdown (standing water) within bore 76,501 is predicted to reduce by approximately 0.5 metres
- the available drawdown (standing water) within bore 76,468 is predicted to reduce by less than 0.1 metres, which is considered unlikely to impact upon yield of this bore.

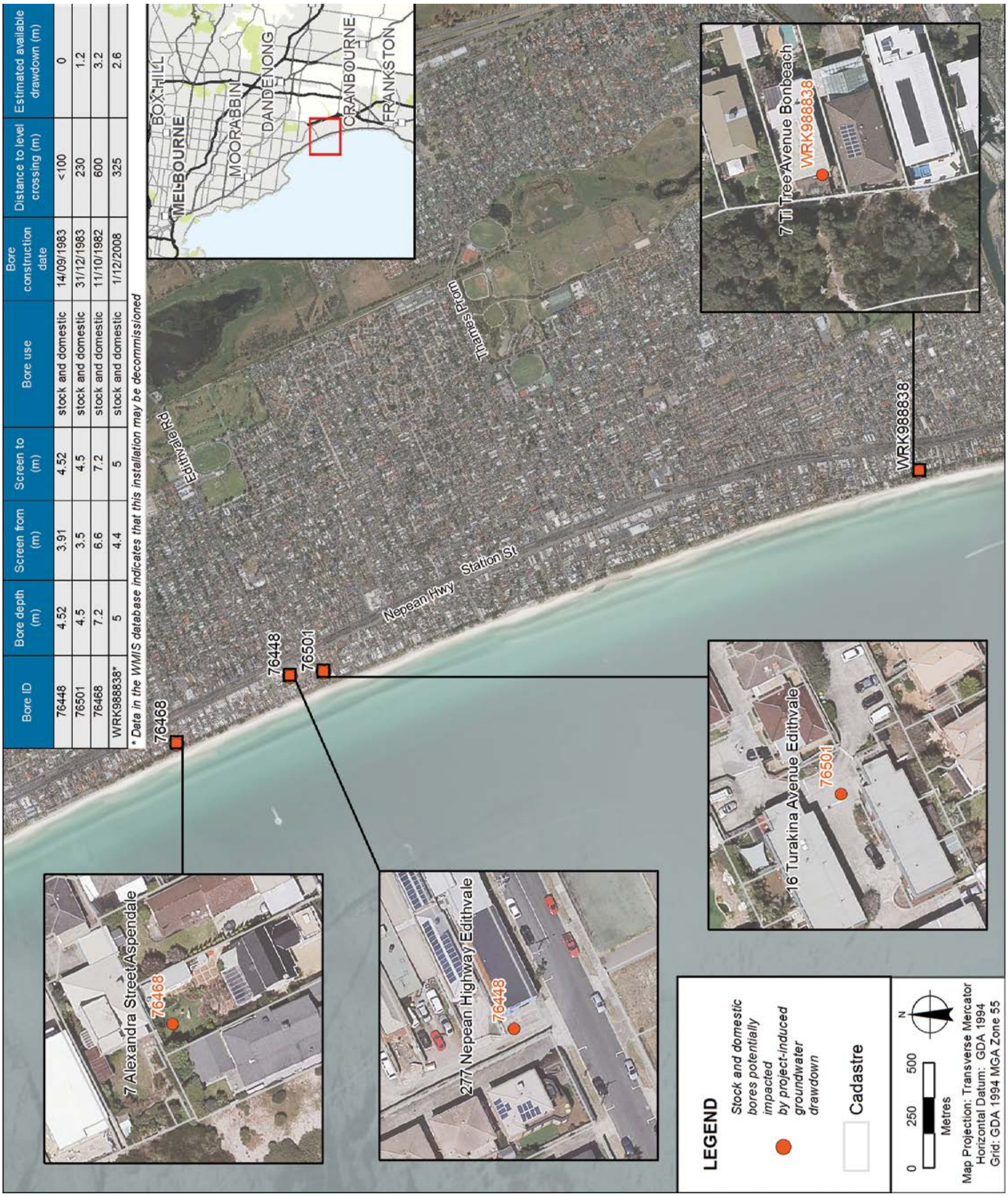
Each of these identified existing bores are over 35 years old, potentially indicating that the bores have reached, or are close to reaching their reasonably expected operational life.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure the project does not result in groundwater level changes that would preclude beneficial uses of groundwater (EPR reference GW2). In order to achieve this environmental performance requirement, the design would need to reduce the magnitude and extent of groundwater level change at Edithvale.

A description of a potential engineering solution and results from the mitigated assessment are included in full in Appendix H of Technical Report A *Groundwater*. The model predictions from the mitigated assessment indicate that the implementation of EPR_GW2 would reduce the likelihood of groundwater level drawdown at Edithvale to less than 0.2 metres within 80 metres of the rail trench. Prior to construction of the trench, an independent peer review would be undertaken by appropriately qualified specialists to confirm that the proposed engineering solution, or any variation or alternative to it, would achieve EPR_GW2 (EPR reference GW4).

Based on these controls, impacts to the groundwater available to existing users caused by groundwater drawdown have been reduced to a negligible risk.

Figure 5.15 Stock and domestic bores potentially impacted by groundwater drawdown



Bore ID	Bore depth (m)	Screen from (m)	Screen to (m)	Bore use	Bore construction date	Distance to level crossing (m)	Estimated available drawdown (m)
76448	4.52	3.91	4.52	stock and domestic	14/09/1983	<100	0
76501	4.5	3.5	4.5	stock and domestic	31/12/1983	230	1.2
76468	7.2	6.6	7.2	stock and domestic	11/10/1982	600	3.2
WRK988838*	5	4.4	5	stock and domestic	1/12/2008	325	2.6

* Data in the WMIS database indicates that this installation may be decommissioned

MELBOURNE
BOX HILL
MOORABBIN
DANDENONG
CRANBOURNE
FRANKSTON
Edithvale Rd
Thames Prom
Nepean Hwy
Station St
76468
76448
76501
WRK988838
7 Ti Tree Avenue Bonbeach
WRK988838
16 Turakina Avenue Edithvale
76501
277 Nepean Highway Edithvale
76448
7 Alexandra Street Aspendale
76468
LEGEND
● Stock and domestic bores potentially impacted by project-induced groundwater drawdown
Cadastre
N
0
250
500
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Subsidence (risk GW59)

Groundwater drawdown may result in land subsidence when the water table is lowered at locations where certain types of saturated soils are present, such as soft, fine-grained sediments. When groundwater drains from pore spaces within the soil layers, the vertical load is redistributed onto the soils, which compacts the soil due to the redistributed load. The related ground subsidence that occurs as a result of the reduction in water pressure and increase in load on the soil specifically, has the potential to damage nearby structures or utilities.

It is possible that land subsidence could impact existing infrastructure that is located within the area of predicted groundwater drawdown, by:

- inducing or rejuvenating existing cracking in settlement sensitive facades and architectural finishings
- local minor impact on settlement sensitive underground services
- local minor impact on roads and pavement.

The risk of damage to buildings and other infrastructure would be dependent on the amount and type of settlement that may occur, and the tolerance of structures to such settlement:

- **Uniform settlement** could occur when land subsidence or settlement occurs evenly or at the same rate throughout all portions of a structure. Structural damage caused by uniform settlement is limited.
- **Differential settlement** could occur when subsidence or settlement occurs unevenly or at differing rates between different portions of a structure. Differential settlement may cause serious structural problems, particularly in tall buildings and could result in bending of structural elements and cracking in structures.

Based on groundwater modelling undertaken in the initial assessment, groundwater drawdown outside the pile wall excavation is estimated to be around 1.4 metres within 50 metres of the trench excavation. Data from a number of geotechnical bores along the Frankston railway line suggests that soils below the water table are relatively competent, except for a thin layer of soft and compressible swamp deposits. The swamp deposits were found to be one to two metres in thickness, occurring at around 10 metres depth. In areas where 1.5 metres of compressible soil is present, surface settlement may be up to 10 millimetres. Settlement would be restricted to the coastal side of the rail trench where groundwater drawdown is predicted.

It is considered that project induced settlement in the order of 10 millimetres due to groundwater drawdown would be unlikely to cause impact in itself, unless buildings or other infrastructure are highly sensitive to movement. The initial risk level at Edithvale associated with settlement was assessed as minor.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure groundwater level changes (as a result of the project) do not result in groundwater drawdown that could cause ground subsidence and adverse impacts to subsurface structures (EPR reference GW2). At Edithvale, to achieve EPR_GW2 implementation of a mitigation measure is required to manage potential changes to groundwater levels and associated impacts. This mitigation would include modifications to the rail trench design, such as the engineering solution described in Section 5.4 (Model results) to minimise project induced changes to groundwater levels. Achieving EPR_GW2 would require a reduction in the likelihood of groundwater level drawdown at Edithvale to less than 0.3 metres within 50 metres of the rail trench, and therefore reduce the residual risk of subsidence to negligible. A Groundwater Management and Monitoring Plan would be implemented to ensure groundwater throughflow is maintained (EPR reference GW3).

The following management measures are proposed to maintain subsidence impacts caused by groundwater drawdown at a negligible risk level:

- an appraisal of existing structures and their potential to be impacted would be undertaken at the detailed design stage (EPR reference GM1)
- for properties and assets affected by subsidence, required repair work would be undertaken or other actions agreed with the property owner, where impacts are attributable to the projects (ERP reference GM2).

Water logging at the ground surface (risk GW61)

The low-lying nature of the Edithvale project area means that it is prone to naturally shallow groundwater levels, with potential for groundwater levels to reach the ground surface during wet climatic periods. This process occurs periodically under existing conditions at Edithvale and is referred to as 'water logging'.

Groundwater mounding on the up-gradient (inland) side of the trench at Edithvale could result in raising of groundwater levels locally at Edithvale, potentially increasing the area and duration of water logging during certain climatic periods.

Groundwater modelling initially assessed the trench without any form of engineering solution to mitigate project induced changes to groundwater. This assessment was used to understand the impacts of water logging at the ground surface. In a portion of the study area at Edithvale (inland of the rail trench), groundwater levels were predicted to mound and result in a water table that occurs at shallower levels or at the ground surface under certain climatic conditions. Under these conditions water logging is likely to occur. Figure 5.16 shows the area at Edithvale that could potentially be affected by shallower groundwater levels as a result of the project, during the period of greatest modelled impact (model year 5). It is worth noting that during a drier period, the area potentially affected by shallower groundwater levels and water logging is predicted to be smaller.

The groundwater model predicted that mounding of the shallow water table may result in impacts at Edithvale, which could include:

- increased soil moisture content
- up to a 11 per cent increase in the frequency and duration of groundwater occurring at the ground surface at Edithvale
- up to a 25 per cent increase in the frequency and duration of groundwater occurring less than 0.5 metres from the ground surface at Edithvale
- in the order of 25 hectares (25,000 square metres) affected by water logging at the ground surface, in addition to approximately 30 hectares that is modelled to be currently affected.

Modelling of the trench without any form of engineering solution to mitigate project-induced changes to groundwater suggested that the project would need to manage risks associated with an increase in the duration of occurrence of groundwater levels that were predicted to occur near the ground surface at Edithvale. Impacts from shallower groundwater levels caused by the project could include temporary, but recurrent increases in subsurface moisture, which could potentially cause wet/boggy ground surface conditions (water logging). These would be most notable in unsealed surface areas, such as public parks, fields and residential backyards. Existing bores may also not be equipped to appropriately manage an increase in groundwater levels, and may result in leakage of groundwater from the bores.

Potential water logging impacts caused by groundwater mounding represent a moderate initial risk at Edithvale, primarily due to social impacts, such as moderate impacts on existing and potential future land uses, most notably the wet/boggy ground surface conditions described above. This would result in a significant and long-term impact to a substantial number of residential properties up-gradient (inland) of the rail trench, across an area of approximately 25 hectares (25,000 square metres).

Water logging as a result of groundwater mounding was considered to be a key project risk that could only be mitigated through changes to the rail trench design for the project. The change in design is guided by the performance requirements outlined under EPR_GW2 , which states that 'the tanked rail trenches at Edithvale and Bonbeach must be designed to ensure that groundwater level changes as a result of the projects do not result in groundwater mounding that increases water logging at the ground level.'

The change in design would limit groundwater level change caused by the project by providing a pathway (such as a passive horizontal drain) for groundwater to flow across the rail trench, and flow towards the groundwater discharge zone (Port Phillip Bay). Implementation of EPR_GW2 would reduce the magnitude and extent of project induced groundwater level changes at Edithvale. This would reduce the likelihood of increases in the occurrence of water logging and reduce the residual risk of water logging at Edithvale to negligible.

A description of a potential engineering solution and results of groundwater modelling undertaken to inform the mitigated assessment, are summarised in Section 5.4 and included in full in Appendix H of Technical Report A *Groundwater*. The potential engineering solution (passive horizontal drain) was developed as a proof of concept example, and modelled to demonstrate that it could provide groundwater flow around the trench and minimise the impact of the project on groundwater levels to the extent that EPR_GW2 can be achieved.

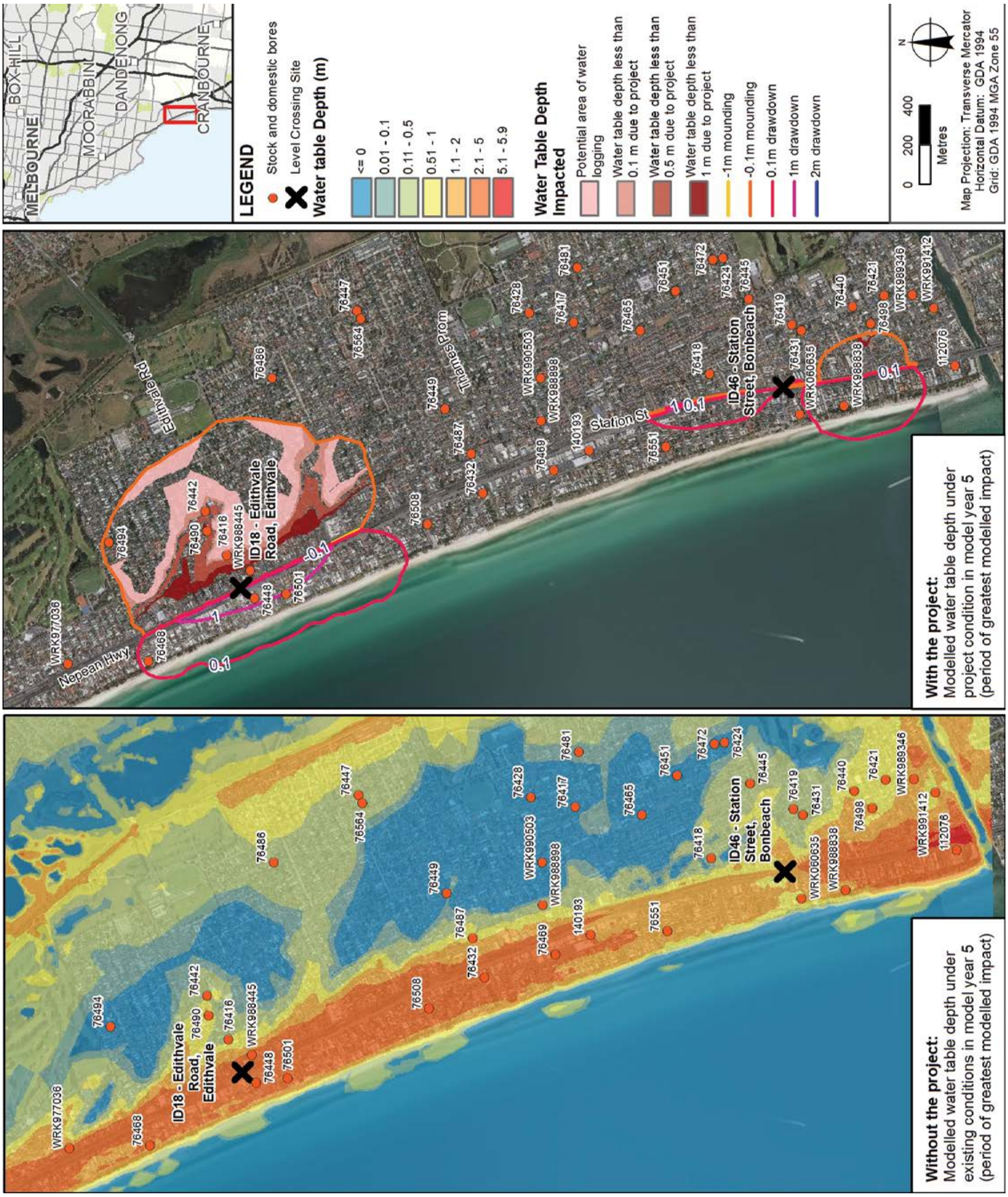
Figure 5.17 demonstrates the effectiveness of the potential engineering solution (passive horizontal drain). The light blue line in Figure 5.17 shows the modelled water table depth relative to ground level under existing conditions, i.e. with no project in place at Edithvale. This data indicates that there were multiple periods in the 20 year simulation period (most notably between model year 7 and model year 9), where the water table depth occurred at or near the ground surface.

The dark blue line in Figure 5.17 shows the modelled water table depth relative to ground level, with the unmitigated project in place at Edithvale. This data indicates that the same periods of potential water logging identified with no project in place still occur, and additional periods of potential water logging (e.g. between model year 5 and model year 7) also occur. The duration of existing potential water logging periods is also increased due to the unmitigated project at Edithvale.

The red dashed line in Figure 5.17 shows the modelled water table depth relative to ground level, with the mitigated project in place at Edithvale (i.e. with the passive horizontal drain in place). This data indicates that groundwater levels are very similar to the existing conditions with no project in place. The model indicates that with the engineering solution in place to mitigate changes to groundwater levels, no additional periods of water logging would occur, and no increases in water logging duration would occur.

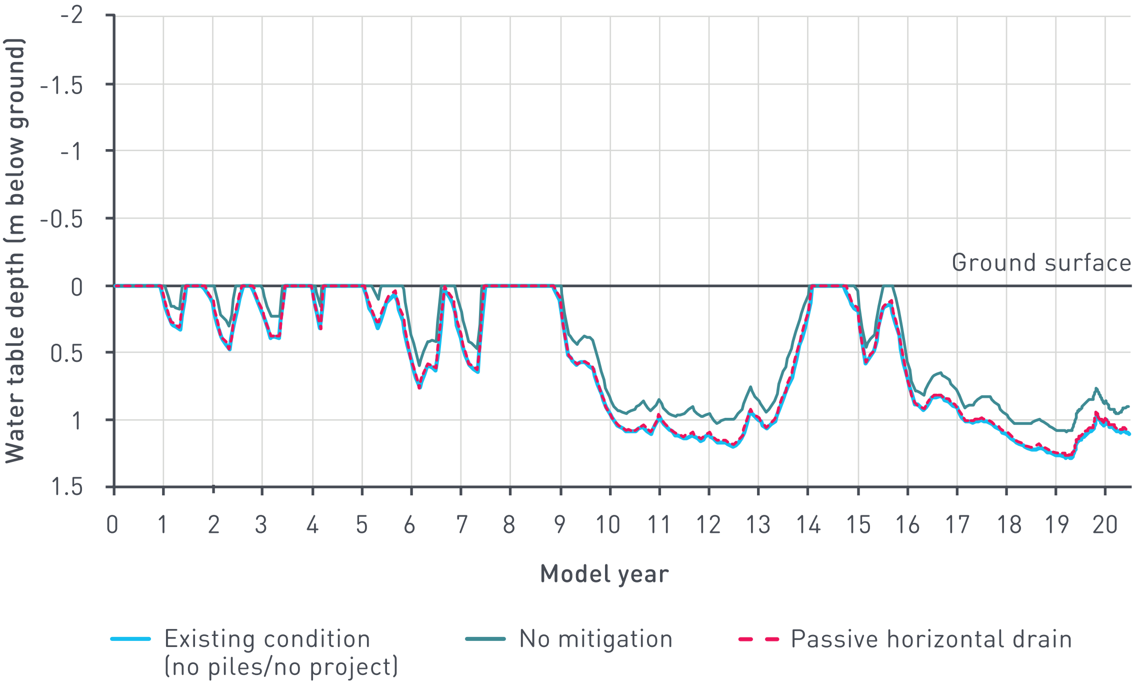
The performance of the installed rail trench would be monitored to confirm it is not having an impact on groundwater levels, in order to ensure that a groundwater level change does not result in groundwater mounding that increases water logging at the ground level (EPR reference GW3). A management and monitoring program would be implemented to maintain groundwater throughflow of the drainage infrastructure (EPR reference GW3).

Figure 5.16 Predicted impacts to water table depth at Model Year 5 (period of greatest modelled impact) based on the initial assessment



LEGEND
● Stock and domestic bores
✕ Level Crossing Site
Water table Depth (m)
<= 0
0.01 - 0.1
0.11 - 0.5
0.51 - 1
1.1 - 2
2.1 - 5
5.1 - 5.9
Water Table Depth Impacted
Potential area of water logging
Water table depth less than 0.1 m due to project
Water table depth less than 0.5 m due to project
Water table depth less than 1 m due to project
-1m mounding
-0.1m mounding
0.1m drawdown
1m drawdown
2m drawdown
0 200 400
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55
MELBOURNE
BOX HILL
MOORABBIN
DANDENONG
CRANBOURNE
ID18 - Edithvale Road, Edithvale
ID46 - Station Street, Bonbeach
Nepean Hwy
Edithvale Rd
Station St
Thames Prom
0.1
1
-0.1
With the project:
Modelled water table depth under project condition in model year 5 (period of greatest modelled impact)
Without the project:
Modelled water table depth under existing conditions in model year 5 (period of greatest modelled impact)

Figure 5.17 Effectiveness of engineering solution – predicted groundwater levels relative to ground level



Impacts to foundations due to water logging (risk GW63)

The permanent pile walls at Edithvale could raise the water table as groundwater flow is impeded, which could increase soil moisture content at, or near the ground surface or result in water logging, which could impact existing subsurface structural foundations.

The area of predicted mounding at Edithvale is largely residential, with properties in this area likely to contain variable footing systems that typically extend less than 0.5 metres below the ground surface. Larger buildings could contain foundations that extend less than one metre from the ground surface. This means that at certain locations, during certain climatic periods (most notably during wet years), existing foundations may already contact the water table under existing conditions.

Based on the initial assessment, there is the potential that shallow groundwater could detrimentally impact existing subsurface foundations within the project area, by increasing the contact time of shallow foundations with the water table.

While the condition of existing subsurface foundations remains unknown, impacts relating to this risk could include increased timber degradation, rising damp, softening or contracting of clay soils. Shallower groundwater levels could result in increased deterioration of concrete and steel subsurface structures, which would reduce their integrity. Shallower groundwater levels could also have an adverse impact on underground tanks and swimming pools, due to uplift or additional pressures acting on the walls of these subsurface structures.

The area at Edithvale predicted through the initial assessment to be affected by a depth to water table of less than one metre due to the project is shown in Figure 5.16. This area extends from the low-lying areas east of the rail line and the coastal sand dune, approximately coinciding with Bridges Avenue, 600 metres east of the rail line at Edithvale, Lochiel Avenue to the north and Elsie Grove to the south.

Based on modelling of the initial assessment, the project would result in a broader occurrence of shallow water table (shallower than one metre below ground surface), however the occurrence, frequency and duration of such shallow groundwater intersecting existing foundations is considered highly improbable. Therefore, impacts to foundations represent a minor initial risk.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure groundwater level changes (as a result of the project) do not result in groundwater mounding that increases the potential for water logging (EPR reference GW2). Compliance with EPR_GW2 would also reduce the likelihood of impacts to foundations as a result of water logging at Edithvale and therefore the residual risk is negligible.

The performance of the project would be monitored to confirm it is not impacting on groundwater levels beyond the groundwater performance outcomes outlined in EPR_GW2. A management and monitoring program would be implemented to maintain groundwater throughflow via project drainage infrastructure (EPR reference GW2).

Saltwater intrusion (risk GW64)

Under natural conditions, an interface of waters of different salinity naturally occurs at the subsurface between the coast and the shore, due to the density contrast between saline seawater and fresher groundwater. In coastal aquifers, the salinity of groundwater increases with depth due to the presence of this interface.

The process of saltwater intrusion can occur due to onshore activities that affect groundwater, such as groundwater drawdown. As groundwater levels become deeper onshore, the subsurface interface has the potential to migrate landward. This could impact the water quality of groundwater, which may become more saline due to the mixing of seawater and fresher groundwater. While groundwater may flow at a particular rate, the movement and mixing of seawater and groundwater would occur at a much slower rate.

Groundwater salinity

Salinity is the measure of total soluble (or dissolved) salt (mineral constituents) in water. The salt content of groundwater is measured as Total Dissolved Solids (TDS). TDS is recorded in milligrams of dissolved solid in one litre of water (mg/L).

Owing to its typically long contact time with mineral-rich soils or rocks, groundwater naturally contains salts and minerals and can be naturally saline. Natural variations in groundwater salinity could occur, due to temporal or climatic changes, or due to human influence.

In Victoria, the beneficial use of groundwater is largely determined through its salinity concentration.

Groundwater modelling to inform the initial assessment predicted that groundwater drawdown would occur on the down-gradient (coastal) side of the trench at Edithvale during operation. Groundwater drawdown may result in impacts resulting from a changed (deeper) water table, including impacts that are specific to aquifers situated near the coast. Specifically, groundwater drawdown may result in saltwater intrusion, such that relatively fresh groundwater may become more saline.

Groundwater modelling was undertaken to assess the significance of potential project-induced changes to groundwater salinity. Salinisation of groundwater could impact the beneficial uses of groundwater, which are protected under the SEPP (Groundwaters of Victoria). A change in the beneficial uses of groundwater as a result of a change in groundwater segment, regardless of whether the use is realised or not, considered pollution under SEPP (Groundwaters of Victoria). Examples of known uses at Edithvale that could be impacted by this change include maintenance of ecosystems (vegetation on the coastal sand dune) and agriculture, parks and gardens (garden watering). Based on the current understanding of the groundwater quality, all beneficial uses identified under SEPP (Groundwaters of Victoria) apply to groundwater in this area including potable (drinking) water, maintenance of ecosystems, agricultural parks and gardens, stock watering, industrial water use, primary contact recreation and buildings and structures.

Groundwater salinity in the water table aquifer is spatially, and likely temporally variable, owing to the complex local groundwater flow regimes described previously in Section 5.1.1. Across the Edithvale project area, the water table aquifer shows fresh groundwater quality ranging from 220 mg/L TDS (Segment A1) to 620 mg/L TDS (Segment A2), each of these segments include potable water supply as a beneficial use.

Limited site-specific data obtained during this investigation indicated that groundwater within the study area could occur within Segment A1 and Segment A2, with no spatial trends apparent based on available data. As a conservative approach, the water table aquifer within the project area has been classified as Segment A1 for the purpose of this assessment and identifying beneficial uses of groundwater to be protected.

The underlying Upper Tertiary Aquifer shows variable groundwater quality, ranging from 1,300 mg/L TDS (Segment B) to 9,900 mg/L TDS (Segment C) at Edithvale. These segments exclude potable water supply as a beneficial use. Trends in the variability of salinity in the water table aquifer have not been identified owing to the limited site specific temporal data obtained during this investigation, which does not consider temporal seasonal variability or longer-term averages in TDS. Salinity trends are, however, likely to be influenced by local natural (e.g. variable recharge) and anthropogenic (e.g. leaking reticulated water mains or urban drainage infrastructure) factors.

Saltwater intrusion modelling based on the initial assessment was used to obtain an indication of the potential magnitude and the rate of change in salinity as caused by the projects at Edithvale and Bonbeach.

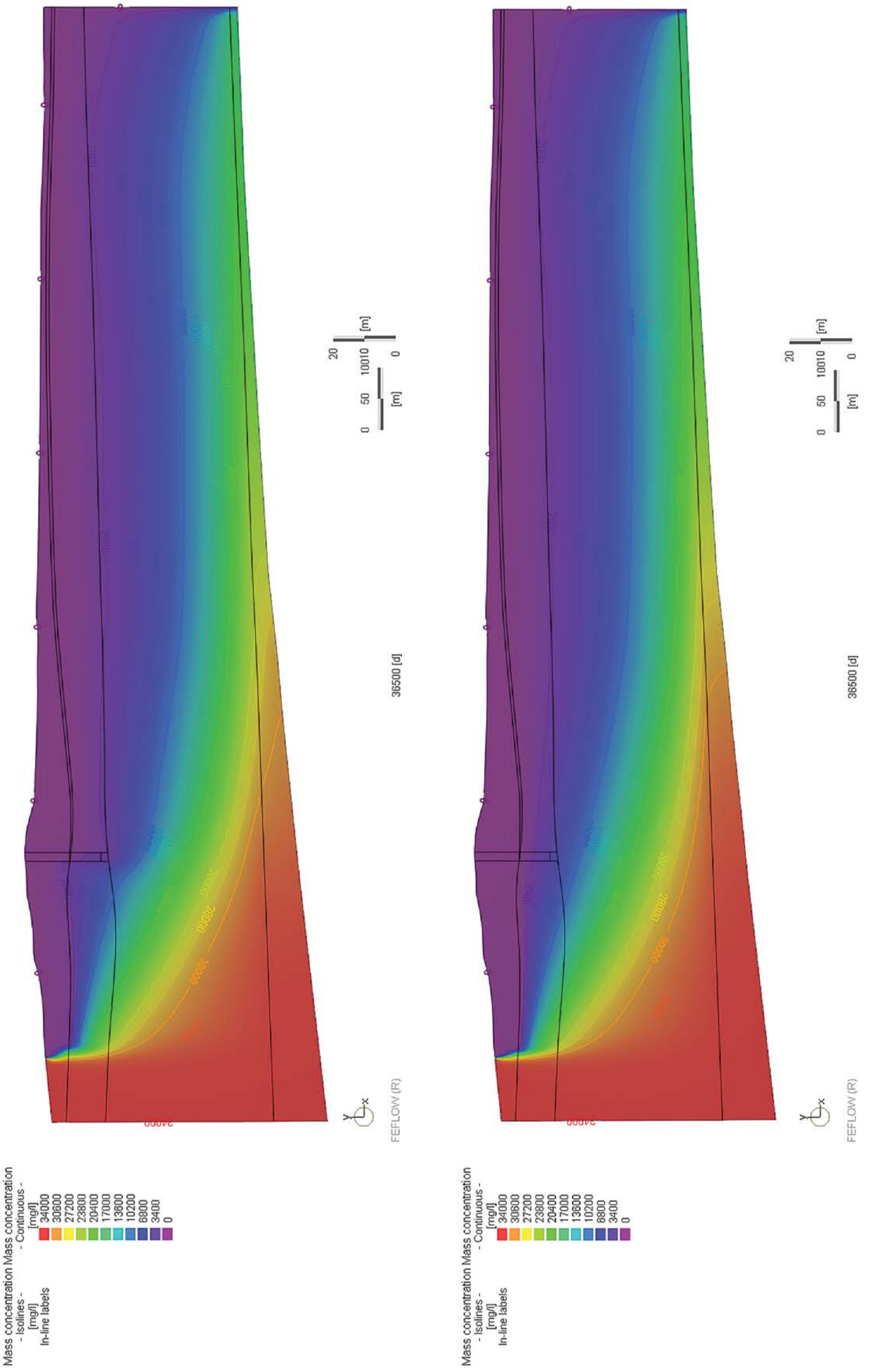
A two-dimensional cross-sectional model was constructed and applied along a representative location within the area. The model was considered representative across the Edithvale and Bonbeach project areas, owing to the following points:

- similar hydrogeological setting conceptualised at Edithvale and Bonbeach
- the cross-section line was centred on the location of maximum predicted impacts to groundwater levels to conservatively estimate impacts across both project areas
- the cross-section line was orientated to intersect the location of existing groundwater monitoring bores, to facilitate model calibration and validation.

As described in Section 5.2.3, the model was run for a 100-year period, to predict potential changes to salinity concentrations. The model calibration indicated that it takes more than 10,000 years for the saltwater wedge to migrate inland from the coastal boundary and reach a steady state condition. This implies that the current location of the saltwater wedge and associated mixing zone would have developed over thousands of years.

Figure 5.18 presents the predicted salinity concentration contours (TDS concentration) after 100 years of project operation, showing a decline in salinity concentration on the up-gradient side (inland) of the trench, and the rise in salinity concentration on the down gradient side (coastal) of the trench.

Figure 5.18 Existing and impacted (after 100 years) salinity concentration contours



Based on the initial assessment, groundwater modelling indicates that drawdown of the water table due to the pile walls has the potential to cause an upward movement of the saltwater wedge. The saltwater wedge however, is predicted to respond slowly to the drawdown and mounding effect, with small changes in salinity of shallow groundwater possibly not evident for several years to decades.

While the saltwater wedge is predicted to move slowly, the salinity of shallow groundwater would be expected to vary seasonally in response to natural climate variations, including changes in groundwater recharge and evaporation. The range of seasonal salinity variations may be comparable to the predicted change in salinity caused by the movement of the saltwater wedge.

Based on the initial assessment, groundwater modelling has predicted the change in salinity in the water table aquifer to be in the order of hundreds of milligrams per litre TDS, and not thousands of milligrams per litre. While these predicted changes in salinity concentrations are minor in that they are within the range of typical variation in salinity for the water table aquifer, the consequence of these predicted changes could be considered moderate, as they could result in the loss of one or more beneficial uses of groundwater.

Given the small changes in concentrations predicted, it would be difficult to differentiate between the minor differences in concentrations that may result due to saltwater intrusion, from expected seasonal and temporal variability in salinity in the water table aquifer.

Irreversible impacts are predicted to occur at Edithvale over a period of 100 years, with model predictions indicating a similar predicted increase in the salinity of shallow groundwater, with and without the effect of climate change (a 0.8 metre increase in sea level and a 53 per cent reduction in recharge).

Predicted changes to groundwater quality as a result of saltwater intrusion have the potential to change the classification of the water table aquifer from Segment A1 to Segment A2 of the SEPP (Groundwaters of Victoria) in some portions of the water table aquifer. Based on the initial assessment, this prediction has been modelled to occur over a period of approximately 25 years, commencing from the installation of the pile walls. After 25 years, minor increases in salinity are predicted to continue. The classification of the water table aquifer would likely not increase beyond Segment A2 of the SEPP (Groundwaters of Victoria), over a period of approximately 100 years commencing from the installation of the pile walls. It should be noted that site specific groundwater data collected from Edithvale indicate that under existing conditions, the water table aquifer exhibits, at some locations, groundwater quality classified as Segment A2.

As demonstrated through the model predictions, even without the project, climate change effects have been modelled to increase groundwater salinity in the water table aquifer during the project life (100 years). This prediction is represented by the blue line in the hydrograph shown in Figure 5.19. As such, it is conceivable that without the project, climate change effects have the potential to change the classification of the water table aquifer from Segment A1 to Segment A2 of the SEPP (Groundwaters of Victoria) locally within the water table aquifer.

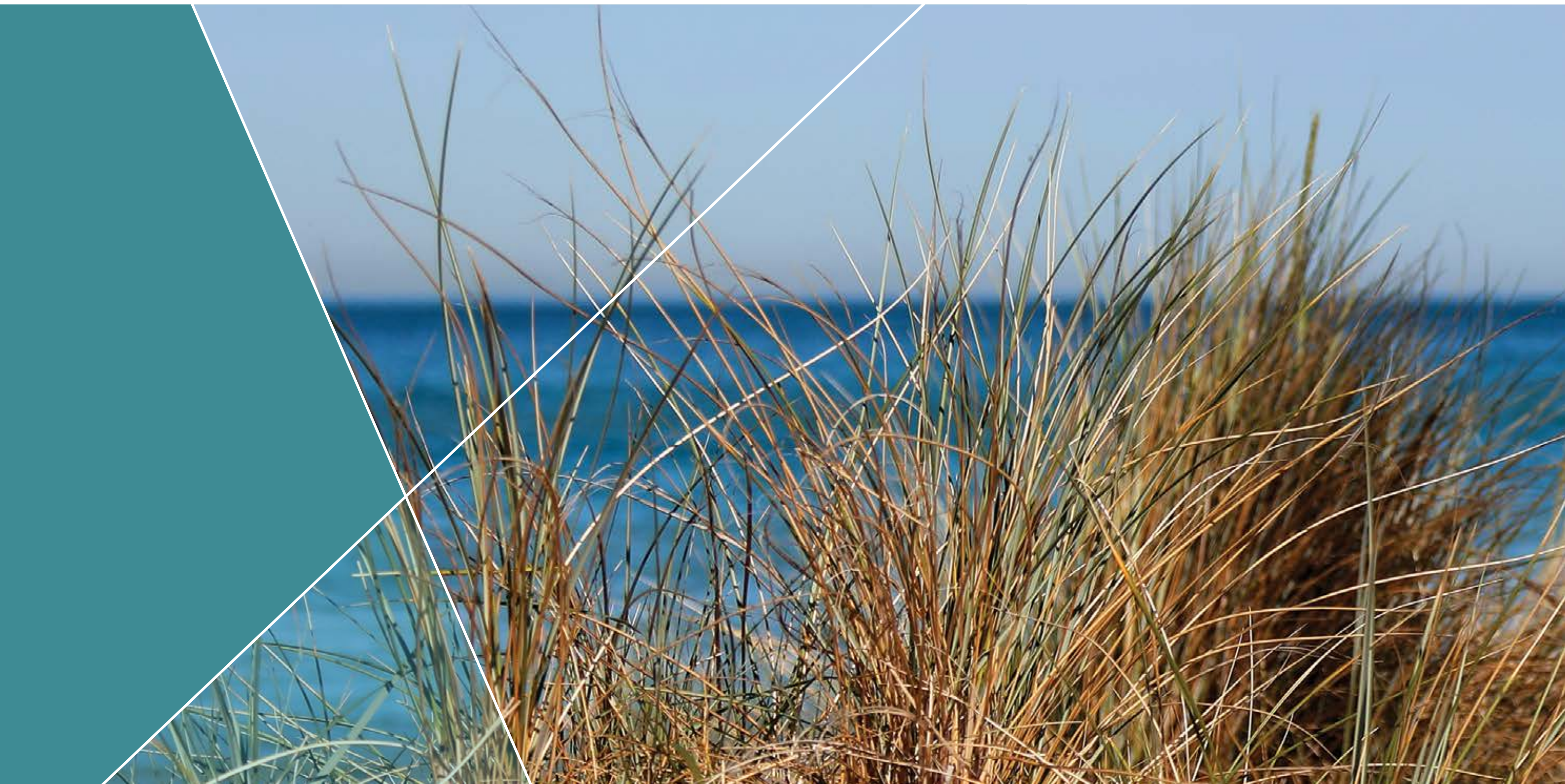
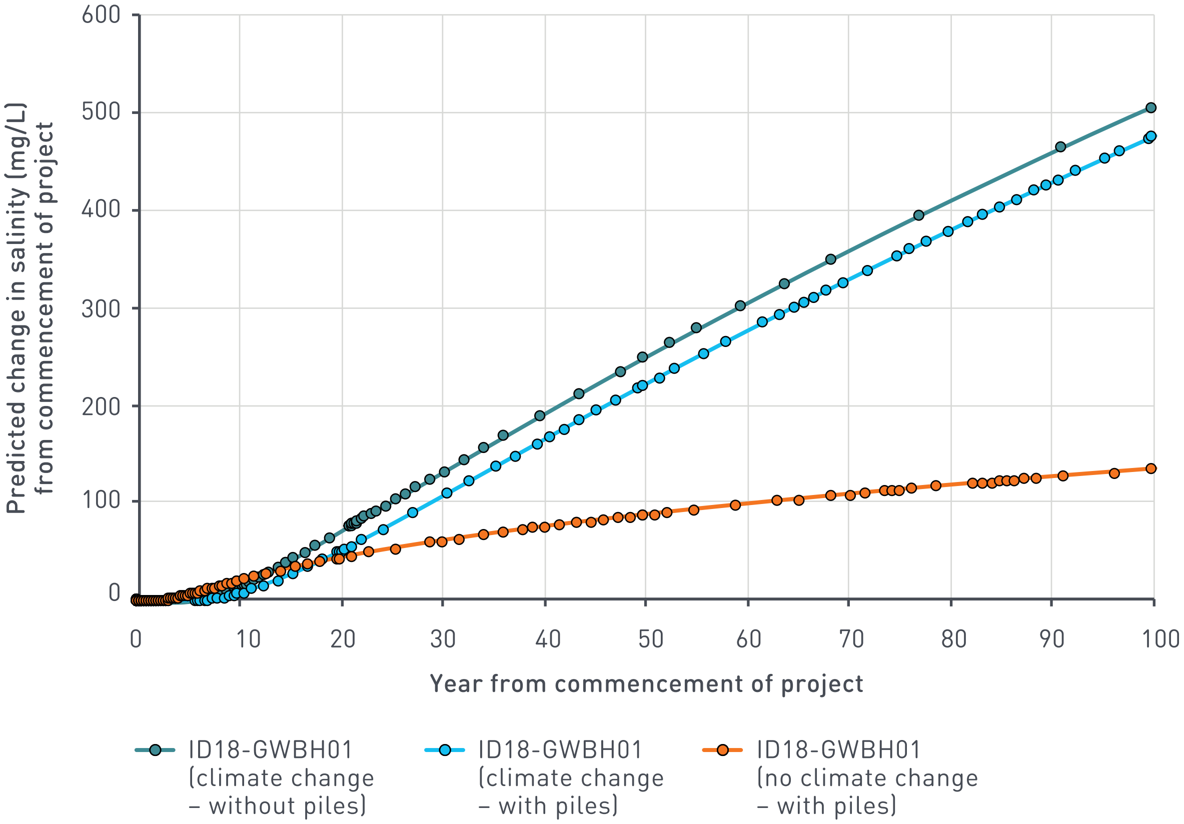


Figure 5.19 Predicted change in salinity (mg/L)



The only beneficial use that would be impacted by these project predictions is a change in the classification of use of groundwater for potable water use from desirable (Segment A1) to acceptable (Segment A2). Under existing conditions at Edithvale, there are potentially background levels of water quality indicators other than TDS (such as selected metals) that may be detrimental to protected beneficial uses, including potable use. As such, there is potential that even under existing conditions, one or more protected beneficial uses does not apply to groundwater in the project area.

Based on the initial assessment, the magnitude and spatial extent of saltwater intrusion impact would be expected to result in consequences that are moderate at Edithvale. At Edithvale, saltwater intrusion impacts represent a moderate initial risk, largely due to the higher magnitude and large spatial extent of drawdown predicted, compared to Bonbeach.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure the project does not result in degradation to groundwater quality that would preclude beneficial use of groundwater (salinity) (EPR reference GW2). To achieve this performance requirement, implementation of a mitigation measure at Edithvale is required to manage potential project induced changes to groundwater levels and quality. This mitigation would include modifications to the rail trench design to minimise changes to groundwater levels, which would result in reduced likelihood of changes to groundwater quality. As such, EPR_GW2 would reduce the likelihood of saltwater intrusion impacts at Edithvale and therefore, the residual risk associated with saltwater intrusion is negligible. Similar modifications to the trench design are not required at Bonbeach to enable compliance with EPR_GW2 because of the lower magnitude and extent of drawdown, which result in sufficiently low resultant risks.

The performance of the installed rail trench would be monitored to confirm it is not having an impact on groundwater levels, to ensure that a groundwater level change does not result in degradation to groundwater quality that would preclude beneficial use of groundwater (salinity) (EPR reference GW3). A management and monitoring program would be implemented to maintain groundwater throughflow of the drainage infrastructure (EPR reference GW3).

Groundwater regime at Edithvale Wetland (risk EG72)

The groundwater model and the wetland hydrological model were used in the initial assessment to assess the potential impacts of groundwater mounding as a result of the project. The wetland hydrological model was used to assess the risk of groundwater mounding as a result of the project and its potential to impact the existing groundwater regime at Edithvale Wetland, which could result in loss of habitat at Edithvale Wetland.

The groundwater model, based on the initial assessment, predicted groundwater mounding to occur up-gradient (inland) of the pile walls at Edithvale. The groundwater modelling was used to simulate subtle changes to the baseflow of the Edithvale Wetland water balance, as a result of project-induced mounding of the water table.

As detailed in Section 5.4 (Model results) during the period of greatest modelled impact (model year 5) based on the initial assessment at Edithvale, groundwater drawdown and mounding impacts that are greater than 0.1 metres do not intersect Edithvale Wetland. The 0.1 metre contour has been adopted as the minimum contour for defining the extent of predicted area of groundwater impact.

Uncertainty analysis indicated that even the 1st percentile confidence limit (left pane in Figure 5.11, which represents a worst case scenario, groundwater drawdown and mounding at Edithvale and Bonbeach does not intersect Edithvale Wetland. The 0.1 metre groundwater mounding contour occurs no closer than 250 metres from the Edithvale Wetland based on the initial assessment. An engineering solution would be implemented at Edithvale to minimise predicted impacts to the groundwater flow regime. An assessment of the engineering solution outlined in this chapter has been undertaken in Section 5.4 (Model results) and in Chapter 2 *Rationale and project descriptions*, which demonstrated that mounding would occur over 1,000 metres away from the wetlands with the engineering solution in place.

Under existing conditions (i.e. without the project), the water table is simulated by the groundwater model to locally and seasonally intersect the ground surface along the western boundary (Centre Main Drain) of the Edithvale Wetland, particularly at low points near the intersection with Edithvale Road. With the projects in place, the increase in volume of water discharging into Centre Main Drain is predicted to be negligible, equating to less than 0.02 per cent change in groundwater discharge rate, which is within the range of natural variability.

The wetland hydrological model was used to assess the potential subtle changes to surface water levels within the wetlands. The model showed that even without the engineering solution in place, there is a negligible risk of changes to the hydrological regime at Edithvale Wetland. Because of this, the hydrological model was not re-run to consider the engineering solution. Figure 5.20 shows minor changes between existing water levels and predicted water levels. A summary of model outcomes are provided below:

- the existing and predicted modelled wetland surface water levels are comparable (note the intersecting 'proposed' and 'existing' lines shown in Figure 5.20)
- the predicted modelled wetland surface water levels occur within the range of existing surface water level variability
- the average increase for all wetland cells across the 20-year model period was 0.4 millimetres, with peak surface water level changes typically occurring for less than one day
- almost all of the modelled differences between existing and predicted (modelled) wetland surface water levels result from a slightly different distribution of surface water between wetland cells (i.e. no net change in water volume, but rather, a change in apportioning of volume between wetland cells)
- the wetland hydrological modelling predicts that very minor changes to baseflow (as a result of the project) leads to equally minor changes to the wetland water levels, with no discernible changes to the wetted extent
- the impacts on wetland water quality were predicted to be negligible, relative to the estimated existing variability in water quality.

Predictive uncertainty analysis was also undertaken on the wetland hydrological model. A summary of the one per cent and 99th per cent confidence limits are summarised below:

- Surface water level changes for the groundwater parameter uncertainty simulations are negligible and difficult to discern in the context of the existing water level variability.
- Peak surface water level changes ranging from a decrease of 0.42 metres to an increase of 0.50 metres are not sustained and rapidly correct on subsequent days.
- Sustained surface water level changes ranged from a decrease of 0.14 metres to an increase of 0.32 metres. These impacts mainly occurred in wetland cell EN2 (which does not currently exhibit a wetting/drying regime). Impacts were predicted when the wetlands were relatively full. While these water level changes are sustained over a period of time they are not sustained in the long term with no inter-annual change in water levels.

Modelling of the wetland also illustrated the impacts on wetland extents and possible changes to habitat type and quantity. In general, minor changes are shown between existing water levels and predicted water levels. The modelling predicted that very minor changes to baseflow (as a result of the project) leads to equally minor changes to the wetland water levels, with no discernible changes to the wetted extent. These are shown in Figure 5.20 and Figure 5.21.

Figure 5.20 shows the surface water extent at Edithvale Wetland in January 2011 (a wet period), for both the existing condition and the project (proposed) condition, based on the initial trench design. Figure 5.21 shows the surface water extent at Edithvale Wetland in March 2016 (a dry period), for both the existing condition and the project (proposed) condition, based on the initial assessment. Neither period shows discernible changes to the wetted extent.

Figure 5.20 Predicted changes to water extent at Edithvale Wetland (January 2011 – wet period)

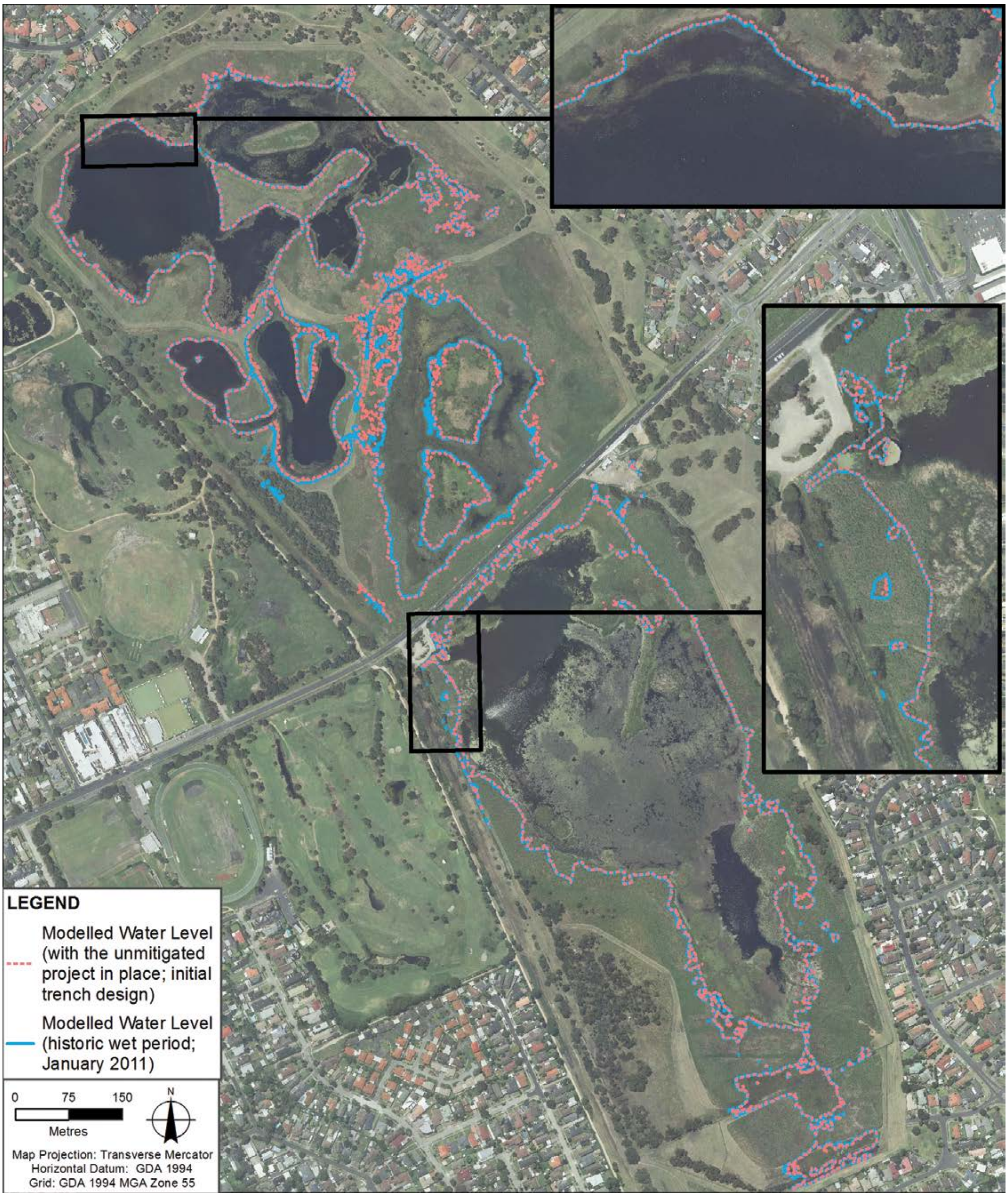
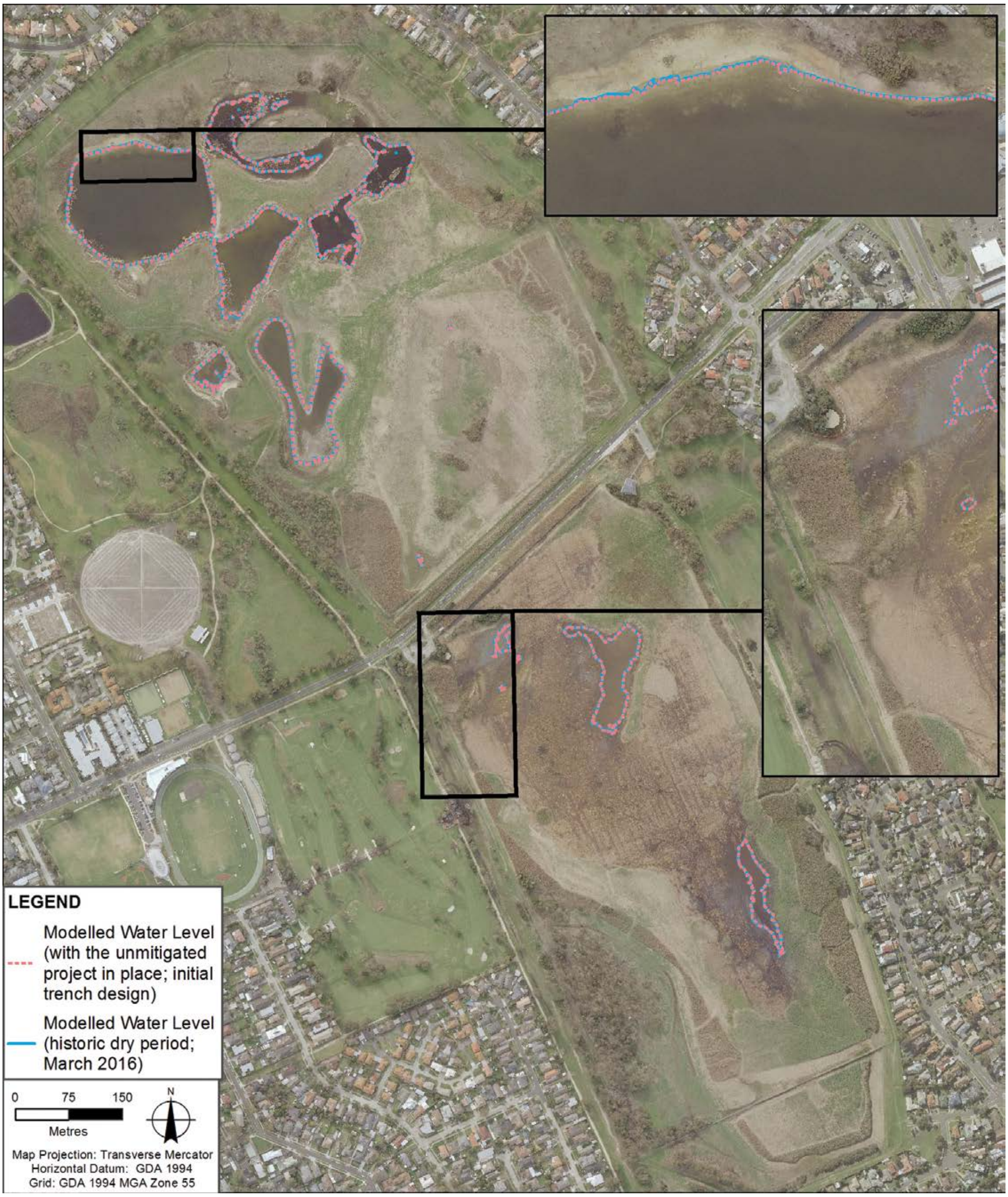

LEGEND
Modelled Water Level (with the unmitigated project in place; initial trench design)
Modelled Water Level (historic wet period; January 2011)
0
75
150
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Figure 5.21 Predicted changes to water extent at Edithvale Wetland (March 2016 – dry period)


LEGEND
Modelled Water Level (with the unmitigated project in place; initial trench design)
Modelled Water Level (historic dry period; March 2016)
0
75
150
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

A detailed summary of the modelled outcomes is provided in Appendix G of Technical Report A *Groundwater*.

Impacts and mitigation on the extent of habitat and associated impacts on waterbird diversity and abundance and capacity to meet Ramsar listing criteria of the Edithvale Wetland section of the Edithvale-Seaford Wetlands Ramsar site are discussed in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems*, along with discussion on the potential impacts to Wannarkladdin Wetlands.

At Edithvale, implementation of an engineering solution is required to manage potential changes to groundwater levels. EPR_GW2 states that the rail trench at Edithvale must be designed to ensure that groundwater level changes (as a result of the project) do not result in changes to groundwater that would have significant impacts on groundwater dependent ecosystems. This mitigation would include modifications to the rail trench design to minimise changes to groundwater levels.

A potential engineering solution (passive horizontal drain) was developed and modelled to inform the mitigated assessment, to demonstrate that groundwater could be maintained around the trench and minimise the impact of the project on groundwater levels, to the extent that EPR_GW2 can be achieved.

Implementation of EPR_GW2 would further reduce the likelihood of impacts to the Edithvale Wetland by reducing the magnitude of predicted groundwater mounding from 0.1 metres at 500 metres from Edithvale Wetland (based on the initial modelled trench design), to 0.1 metres at over 1,000 metres away from Edithvale Wetland (based on the engineering solution).

A description and preliminary assessment of a potential engineering solution is presented in Section 5.4 (Model results). The performance of the installed rail trench would be monitored to confirm it is not having an impact on groundwater levels, in order to ensure that groundwater level changes do not result in changes to groundwater that would have significant impacts on groundwater dependent ecosystems (EPR reference GW3). A Groundwater Dependent Ecosystem Monitoring and Mitigation Plan would be implemented at Edithvale Wetland if a change to groundwater level or quality that is not in accordance with EPR_GW2 is observed (EPR reference FF8). This would include monitoring of groundwater and surface water levels and quality at representative and strategic locations within and around the Edithvale Wetland. Refer to Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* for further detail.

A management and monitoring program would be implemented to maintain groundwater throughflow of the drainage infrastructure (EPR reference GW3).

The residual risk of impacts to the Edithvale Wetland remains at negligible.

5.6.2 Bonbeach

An initial risk assessment was undertaken to assess potential risks to the environment arising from the implementation of the project at Bonbeach. As discussed in Section 5.4 (Model results), the predicted groundwater mounding and drawdown at Bonbeach is significantly less when compared to the model predictions from the initial assessment at Edithvale.

After the initial risk assessment, an EPR was developed which would reduce the magnitude and extent of project induced groundwater level changes. EPR_GW2 states that the rail trenches at Edithvale and Bonbeach must be designed to ensure groundwater level changes (as a result of the projects) do not result in:

- groundwater mounding that increases water logging at ground level
- groundwater drawdown that could cause ground subsidence and adverse impact to subsurface structures
- degradation to groundwater quality that would preclude beneficial use of groundwater (salinity, contaminants, CASS)
- changes to groundwater that would have significant impacts on GDEs.

Based on findings of the initial assessment, the risk and impact assessment process did not identify a requirement to modify the initial design at Bonbeach in order to reduce changes in groundwater levels to meet EPR_GW2. That is, the risks caused by groundwater level changes at Bonbeach were considered sufficiently low, such that mitigation, beyond the project design, would not be required. The pile wall configuration proposed includes measures that minimise potential impacts to groundwater, including stepped depths of impermeable piles. Refer to Chapter 2 *Rationale and project descriptions* for further detail. A Groundwater Management and Monitoring Plan would be developed for the project to manage predicted and potential impacts to groundwater following construction of the pile walls (EPR reference GW3).

As a result, the initial and residual groundwater risks identified for the operation phase of the Bonbeach level crossing removal project do not change, and are outlined in Table 5.5.

Risks associated with activation of acid sulfate soils as a result of groundwater drawdown (risk GW67) and contaminant migration as a result of groundwater mounding (risk GW69) are discussed in Chapter 7 *Acid sulfate soils and contamination.*

Table 5.5 Bonbeach groundwater risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW65	Interference with users – Bonbeach	Drawdown on the down-gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 – Rail trench design	Minor	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes	Minor
GW66	Subsidence – Bonbeach	Drawdown on the down gradient side of trench could result in subsidence of unconsolidated subsurface sediments resulting in adverse impact to structures.	EPR GW1 – Rail trench design EPR GM1 – Pre – construction condition survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GM1 – Pre – construction condition survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Negligible
GW67	CASS activation – Bonbeach	Drawdown on the down-gradient side of the trench could result in changes in groundwater levels, which could give rise to activation of CASS and/or mobilise any existing acidity and groundwater acidification affecting beneficial uses of land and groundwater.	EPR GW1 – Rail trench design	Minor	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Minor

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW68	Water logging – Bonbeach	Mounding on the up-gradient side of trench results in increasing the spatial area and duration that the subsurface experiences groundwater levels at or near the ground surface.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible
GW69	Contaminant migration – Bonbeach	Mounding on the up-gradient side of trench, drawdown on down gradient side of trench, and groundwater physically diverted either to the north or south along the up gradient side of the trench could alter contamination plume migration adversely impacting on beneficial uses of land and groundwater.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – SMP EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR CL5 – Acidic and/or contaminated groundwater (operation)	Negligible
GW70	Foundations – Bonbeach	Mounding on the up-gradient side of trench could result in increasing the spatial area and duration that existing subsurface foundations experience groundwater levels at, or near the ground surface.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW71	Saltwater intrusion – Bonbeach	Drawdown on down-gradient side of trench could result in inland migration of the saltwater wedge and salinisation of aquifers, resulting in change in beneficial use of groundwater.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible
EG80	Wannarkladdin Wetlands – Bonbeach	Groundwater mounding leading to altered hydrological regime and/or water quality resulting in loss of native vegetation and/or fauna habitat associated with Wannarkladdin Wetlands.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible

Interference with groundwater users (risk GW65)

During operation, groundwater drawdown is predicted on the down-gradient side of the trench at Bonbeach, which has the potential to impact the availability of groundwater for existing registered groundwater users. As defined in Section 5.1.3, users access groundwater either through licenced extraction bores or 'stock and domestic' bores.

All licensed groundwater extraction bores are situated beyond the predicted area of drawdown of the projects based on the initial assessment. Therefore, the existing licensed groundwater extractions are not predicted to be impacted by the project.

There is one stock and domestic bore (WRK988838) identified through the DELWP Water Measurement Information System located within the predicted area of drawdown of the Bonbeach level crossing removal project (refer to Figure 5.15. Groundwater modelling to inform the initial assessment suggests that at this bore, the predicted drawdown equates to small reductions in the available drawdown (standing water), which is considered unlikely to impact upon the amount of groundwater available from this bore.

The data obtained from the DELWP Water Measurement Information System indicates that the identified stock and domestic groundwater bore may have been decommisioned and may no longer be operational.

A bore census undertaken on 23 November 2017, aimed at identifying the stock and domestic bore (WRK988838), which according to Southern Rural Water's records (which do not provide a specific address), would be situated around 7 Ti-Tree Avenue, Bonbeach. The bore (WRK988838) was not clearly identified during the census. The census highlighted the presence of several additional groundwater bores at residential properties on Ti-Tree Avenue, Bonbeach. Since these bores are not on Southern Rural Water's register and water use is not registered with Southern Rural Water, an accurate location, construction details or use cannot be confirmed for these unregistered bores.

Numerous properties were identified with ‘bore water in use’ signage at the front of the properties. Identifying the precise location and construction details of these bores would require notification to the landowner and agreement of the landowner for LXRA to undertake this assessment. Such an approach also relies upon the assumption that only those sign posted properties have existing groundwater bores installed. Such an extensive investigation was not undertaken for the EES, as the assessment assumed that bores were present.

While potential impacts to one existing groundwater user (WRK988838) have been identified, the status of this bore, and potential additional unregistered bores was not able to be confirmed. There is a chance that the registered bore was either decommissioned or destroyed, or simply not used by the current residents.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench at Bonbeach would be designed to ensure that groundwater level change does not result in precluding beneficial uses of groundwater (EPR reference GW2). Minor impacts to a small number of individuals could possibly occur as a result of groundwater drawdown caused by the pile walls at Bonbeach, resulting in a minor risk.

Subsidence (risk GW66)

Potential impacts relating to subsidence as a result of groundwater drawdown have been described previously in Section 5.6.1 (risk GW59). At Bonbeach, groundwater drawdown of up to 0.7 metres is predicted within 50 metres of the rail trench, with drawdown of up to 0.3 metres predicted near the coastline approximately 150 metres from the rail trench.

Data from a number of geotechnical bores drilled along the Frankston railway line to inform the EES suggest that soils below the water table are relatively competent, except for a thin layer of soft and compressible swamp deposits. The swamp deposits were found to be one to two metres in thickness, occurring at around 10 metres depth. In areas where 1.5 metres of compressible soil is present, surface settlement may be up to 5 millimetres. Settlement would be restricted to the coastal side of the rail trench where groundwater drawdown is predicted.

The resultant risk of subsidence caused by the project is directly related to the magnitude and extent of drawdown predicted, combined with the presence of a thin layer of soft and compressible soil. It is considered that project induced settlement in the order of 5 millimetres due to groundwater dewatering would be very unlikely to cause moderate impacts in itself, unless buildings or other infrastructure are highly sensitive to movement.

The nature and condition of existing buildings and infrastructure is not known. It is possible that minimal ground movement could induce or rejuvenate existing cracking in settlement sensitive facades and architectural finishings. Local minor impact on settlement sensitive buried services and infrastructure within the area of predicted groundwater drawdown is also possible.

At Bonbeach, subsidence is considered to be a negligible risk as settlement is estimated to be minimal. No further mitigation is required since subsidence is very unlikely to occur, and if it did, would not result in major impact on existing or potential future land uses.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure groundwater level changes (as a result of the project) do not result in groundwater drawdown that could cause ground subsidence and adverse impacts to subsurface structures (EPR reference GW2). A management and monitoring plan program would be implemented to ensure groundwater throughflow is maintained (EPR reference GW3).

The following management measures are proposed to maintain subsidence impacts caused by groundwater drawdown at a negligible risk level:

- an appraisal of existing structures and their potential to be impacted would be undertaken at the detailed design stage (EPR reference GM1)
- for properties and assets affected by subsidence, required repair work would be undertaken or other actions agreed with the property owner, where impacts are attributable to the projects (ERP reference GM2).

Water logging at the ground surface and impacts to foundations (risks GW68 and GW70)

The numerical groundwater model was used to assess the impacts of water logging at the ground surface. In a portion of the study area at Bonbeach, groundwater mounding is predicted to occur based on the initial assessment, resulting in a shallower water table (refer to Figure 5.14).

The assessment predicted that water logging does not occur under existing conditions at Bonbeach and is considered very unlikely to occur as a result of the project, based on the initial assessment largely owing to:

- the deeper water table at Bonbeach, which is typically deeper than one metre below ground surface, even during the period of greatest modelled impact
- the more complex local groundwater flow regime at Bonbeach, which acts to disperse groundwater flow towards Port Phillip Bay and Patterson River.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure groundwater level changes (as a result of the project) do not result in groundwater mounding that increases the potential for water logging (EPR reference GW2).

Water logging impacts, including impacts to foundations are not predicted at Bonbeach, therefore the risk is negligible. No further mitigation is required as water logging is very unlikely to occur at Bonbeach, and if it did, would not result in major impact on existing or potential future land uses.

Saltwater intrusion (risk GW71)

Groundwater modelling to inform the initial assessment predicted that groundwater drawdown would occur on the down-gradient (coastal) side of the trench at Bonbeach during operation. Groundwater drawdown may result in impacts resulting from a changed (deeper) water table, including impacts that are specific to aquifers situated near the coast. Specifically, groundwater drawdown may result in saltwater intrusion, such that relatively fresh groundwater may become more saline.

Groundwater modelling was undertaken to assess potential project-induced changes to groundwater salinity. Salinisation of groundwater could impact the beneficial uses of groundwater, which are protected under the SEPP (Groundwaters of Victoria).

Similar to Edithvale, the water table aquifer within the project area is classified as Segment A1 for the purpose of this assessment and identifying beneficial uses of groundwater to be protected.

Trends in the variability of salinity in the water table aquifer have not been identified owing to the limited site-specific temporal data obtained during this investigation, which does not consider temporal seasonal variability or longer-term averages in TDS. Salinity trends are however, likely to be influenced by local natural (e.g. variable recharge) and anthropogenic (e.g. leaking reticulated water mains or urban drainage infrastructure) factors.

Saltwater intrusion modelling was used to obtain an indication of the potential magnitude and the rate of change in salinity as caused by the project in the study area. Section 5.6.1 (risk GW64) outlines the predicted changes to groundwater salinity in the project area as a result of movement of the saltwater wedge. The modelling indicated that drawdown of the water table due to the pile walls, has the potential to cause upward movement of the saltwater wedge.

Saltwater intrusion impacts at Bonbeach would be expected to be minor compared to the predictions for Edithvale, given the lesser extent of drawdown predicted to occur at Bonbeach.

The modelling has predicted the change in salinity to be in the order of:

- less than 500 mg/L TDS in the Quaternary Aquifer over a period of decades
- less than 750 mg/L TDS in the Upper Tertiary Aquifer over a period of decades
- less than 1,000 mg/L TDS in the Upper – Middle Tertiary Aquitard over a period of decades.

These changes in salinity would occur on the down gradient side of the pile wall (between the coast and the pile walls), within the predicted area of drawdown at Bonbeach (23 hectares).

Predicted changes to groundwater quality as a result of saltwater intrusion has the potential to change the classification of the water table aquifer from Segment A1 to Segment A2 of the SEPP (Groundwaters of Victoria) in some portions of the water table aquifer that could currently be classified as Segment A1. However, it is important to note that variable water quality (i.e. less than 700 mg/L TDS) exists within the water table aquifer at Bonbeach. Groundwater quality of the water table aquifer at Bonbeach would not exceed Segment A2 of the SEPP (Groundwaters of Victoria) over a period of 100 years.

The only element of protected beneficial use that could be impacted by the project predictions is the change of potable water supply from desirable to acceptable, in selected locations within the project area. As mentioned previously, some locations within the project area show water quality consistent with acceptable potable water supply under existing conditions.

The increase in salinity caused by the movement of the saltwater wedge would likely be in the range of seasonal salinity variations in the water table aquifer. During the project life cycle, it is highly probable that either natural variations (e.g. those caused by climate change) or changed conditions induced by the project, could increase groundwater salinity in the water table aquifer. Even without the project, climate change effects have been modelled to increase groundwater salinity in the water table aquifer during the project life and have the potential to change the classification of the water table aquifer from Segment A1 to Segment A2 of the SEPP (Groundwaters of Victoria) in some portions of the water table aquifer.

At Bonbeach, saltwater intrusion impacts represent a minor risk under the initial assessment, which is lower than the same risk at Edithvale due to the smaller extent of drawdown predicted at Bonbeach, and reduced saltwater intrusion impacts.

The rail trench would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trench must be designed to ensure groundwater level changes (as a result of the project) do not result in degradation to groundwater quality that would preclude beneficial use of groundwater (salinity) (EPR reference GW2). The saltwater intrusion risk at Bonbeach would be managed through a monitoring and an impact verification approach (EPR reference GW3), and implementation of salinity management measures (if required), through the Groundwater Quality Mitigation Plan (EPR reference CL5). If required, EPR_CL5 could be developed to identify measures to maintain or manage the beneficial use of groundwater affected by salinisation.

Groundwater regime at Wannarkladdin wetlands (Risk EG80)

The numerical groundwater model predicted groundwater mounding to occur up-gradient (inland) of the pile walls at Bonbeach, with impacts of up to 0.1 metres predicted less than 200 metres to the east of the rail trench. Mounding of 0.1 metres is predicted to occur approximately 1,500 metres from Wannarkladdin Wetlands.

Figure 5.11 in Section 5.4 (Model results) shows that based on uncertainty analysis, the 1st, 50th and 99th percentile confidence predictions groundwater mounding does not impact Wannarkladdin Wetlands. The 1st percentile confidence limit shows that 0.1 metres of groundwater mounding is predicted approximately 700 metres west of Wannarkladdin Wetlands, resulting in an almost impossible likelihood of moderate impacts to the wetlands, including changes to wetland baseflow.

Impacts and mitigation on the extent of habitat and abundance of native vegetation/fauna of the Wannarkladdin Wetlands are discussed in Chapter 6 *Edithvale-Seaford Wetland and groundwater dependent ecosystems*. Chapter 6 concludes that impacts on habitat and species diversity are not expected as a result of the level crossing removal project at Bonbeach.

The risks caused by groundwater level changes at Bonbeach were considered sufficiently low such that mitigation, beyond the project design outlined in Chapter 2 *Rationale and project descriptions* would not be required. The pile wall configuration proposed includes measures that minimise potential impacts to groundwater, including stepped depths of impermeable piles. A Groundwater Management and Monitoring Plan would be developed for the project, to manage predicted and potential impacts to groundwater following construction of the pile walls (EPR reference GW3). This EPR includes triggers for additional monitoring of ecology.

The residual risk of impacts to the Wannarkladdin Wetlands remains at negligible.

5.7 Conclusion

The projects would be designed within the parameters outlined in Chapter 2 *Rationale and project descriptions* (EPR reference GW1). The rail trenches at Edithvale and Bonbeach would be designed to ensure groundwater level changes (as a result of the projects) do not result in the following potential impacts identified as higher risks during the assessment undertaken for this EES (EPR reference GW2):

- groundwater mounding that increases water logging at ground level
- groundwater drawdown that could cause ground subsidence and adverse impact to subsurface structures
- degradation to groundwater quality that would preclude beneficial use of groundwater (salinity, contaminants, CASS)
- changes to groundwater that would have significant impacts on GDEs.

The performance of the installed rail trenches would be monitored to confirm they are not having an impact on groundwater levels and quality beyond those set out above (EPR reference GW2). A Groundwater Management and Monitoring Plan (EPR reference GW3) would be implemented to the satisfaction of EPA Victoria and relevant water authorities to manage predicted and potential impacts to groundwater following construction of the piled trench walls. The plan would include clear trigger levels for changes in groundwater level and quality that would require mitigation plans to be implemented. A management and monitoring plan would be implemented to maintain groundwater throughflow of the drainage infrastructure required at Edithvale (EPR reference GW2).

Predictive groundwater modelling based on the parameters included in Chapter 2 *Rationale and project descriptions* was used to assess the risks outlined above. Groundwater levels are predicted to increase on the up gradient (inland) side of the pile walls and decrease on the down gradient (coastal) side of the pile walls, as groundwater throughflow is impeded by the pile walls.

Edithvale

The risks caused by groundwater level changes at Edithvale were initially predicted to be greater than at the Bonbeach level crossing removal site based on modelling to inform the initial assessment.

At Edithvale, groundwater mounding (increase in groundwater level) of up to 0.9 metres within 50 metres of the rail trench was predicted from the initial modelling based on the parameters outlined in Chapter 2 *Rationale and project descriptions*. Groundwater drawdown (decrease in groundwater level) of up to 1.4 metres within 50 metres of the rail trench was predicted from the initial modelling.

Because of the impacts predicted through the initial assessment for Edithvale, potential modifications to the design were considered, to minimise the impacts.

An engineering solution was developed and modelled to demonstrate that groundwater could flow around the trench, thus maintaining the existing groundwater flow regime and minimising the impact of the project on groundwater levels to the extent that the performance outcomes in EPR_GW2 could be achieved.

The engineering solution that was modelled comprises a passive horizontal drain, which is an underground pipe that would be installed around the outside of, and adjacent to, the pile walls. The pipe would be installed at a depth that is permanently below the naturally variable water table, and perforated to allow water inflow and outflow.

The modelling indicated that the engineering solution would reduce impacts to groundwater levels at Edithvale, resulting in:

- groundwater mounding (increase in groundwater level) of up to 0.2 metres within 50 metres of the rail trench
- groundwater drawdown (decrease in groundwater level) of up to 0.3 metres within 50 metres of the rail trench.

The modelled engineering solution would maintain groundwater levels to existing conditions (within acceptable tolerances), such that impacts to groundwater quality resulting from the project would be maintained as close as practicable to background levels.

The final constructed design must meet the performance requirements listed in EPR_GW2 in order to achieve this outcome. Prior to construction of the trench, an independent peer review by an appropriately qualified specialist would be undertaken of the proposed design to confirm that the design would achieve EPR_GW2 (EPR reference GW4).

Bonbeach

The risks caused by groundwater level changes at Bonbeach were considered sufficiently low, such that alteration to the modelled design would not be required in order to achieve the performance outcomes listed in EPR_GW2 (refer Chapter 9 *Environmental Management Framework*).

At Bonbeach, groundwater mounding (increase in groundwater level) of up to 0.4 metres within 50 metres of the rail trench was predicted through the initial assessment, along with groundwater drawdown (decrease in groundwater level) of up to 0.7 metres within 50 metres of the rail trench.

The lesser impact predicted at Bonbeach is primarily due to the local groundwater flow regimes, where the local groundwater flow direction is perpendicular to the pile wall at the Edithvale level crossing removal site, resulting in greater impedance of groundwater throughflow. At the Bonbeach level crossing removal site, groundwater flow is locally towards the south, towards Patterson River. At areas where the flow line is parallel to the pile wall, less impedance on groundwater throughflow is predicted.

The locations of the pile walls relative to the location of the local groundwater flow divide at Bonbeach also act to reduce impacts predicted at Bonbeach. At Bonbeach, the groundwater flow divide is inferred to approximately coincide with the rail trench, resulting in limited opportunity for the pile walls to interrupt lateral flow of groundwater across the rail trench.

The modelling identified that the magnitude and extent of groundwater level impacts resulting from the project are highly sensitive to the climatic condition at a given point in time.

To mitigate subsidence impacts caused by groundwater drawdown at Edithvale and Bonbeach, an appraisal of existing structures and their potential to be impacted would be undertaken at the detailed design stage, and repairs undertaken following works if required.

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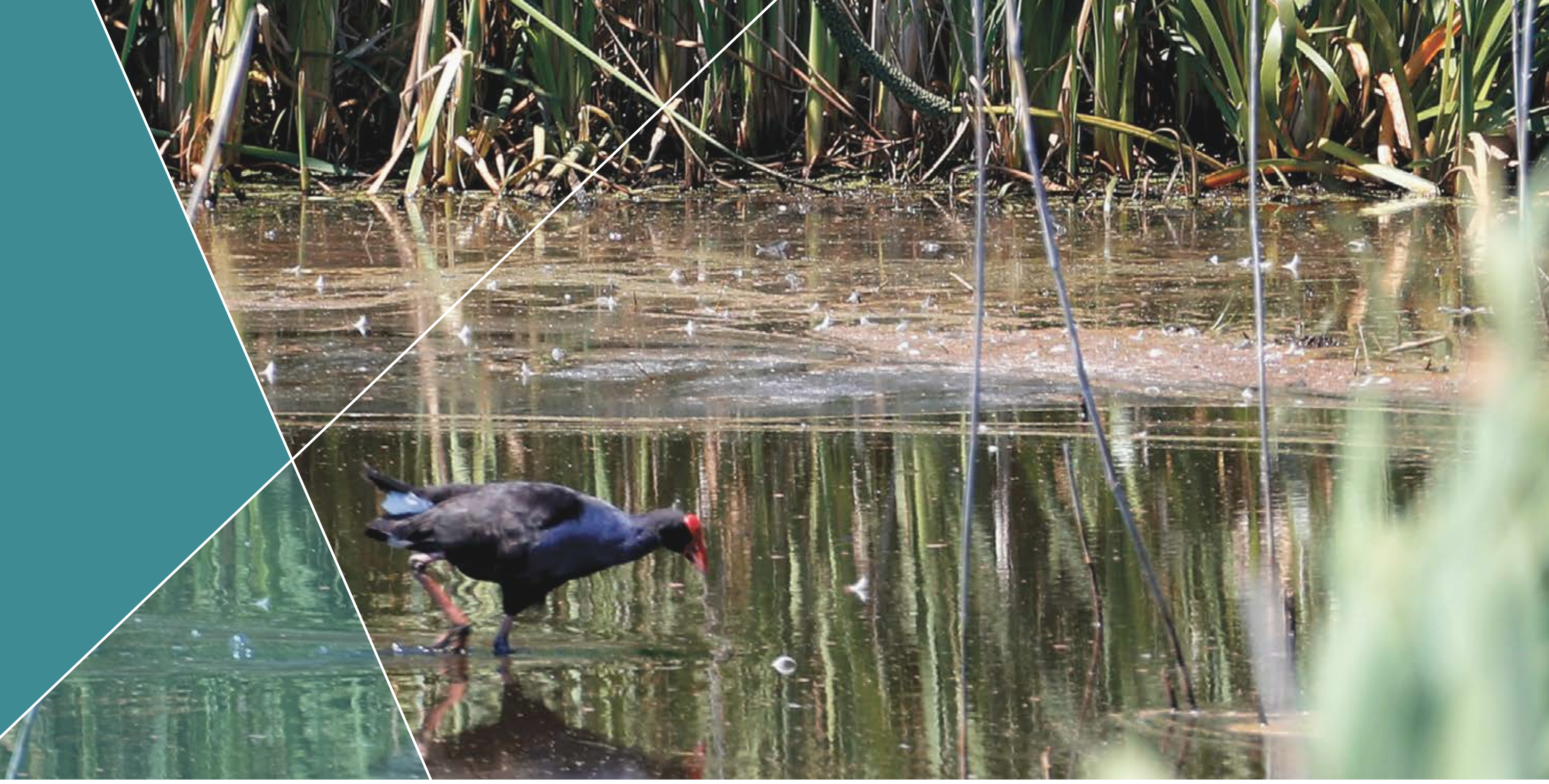

6 EDITHVALE-SEAFORD WETLANDS AND GROUNDWATER DEPENDENT ECOSYSTEMS

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This chapter identifies groundwater dependent ecosystems (GDEs) in close proximity to the Edithvale and Bonbeach level crossing removal projects and assesses the potential effects on them as a result of the predicted changes to groundwater discussed in Chapter 5 *Modelling the water environment*.

The Scoping Requirements for the EES include the following relevant evaluation objective:

- **Biodiversity** – to avoid, minimise and/or offset adverse effects on native vegetation, listed threatened species and ecological communities, listed migratory species, the Ramsar listed Edithvale-Seaford Wetlands, other protected flora and fauna and groundwater dependent ecosystems.

To assess the potential effects of the Edithvale and Bonbeach level crossing removal projects on GDEs, a regional numerical groundwater model and local wetland hydrological model for the Edithvale component of the Edithvale-Seaford Wetlands were developed. The outputs of the models, presented in Chapter 5 *Modelling the water environment*, form the basis for the groundwater related assessments in this chapter.

Section 4.2 of the Scoping Requirements requires a description of the ecological character of the wetlands and the threatened species that use them. An ecological impact assessment detailing the ecological values of wetlands and other GDEs has been prepared in response to the Scoping Requirements and is provided in Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*. The discussion regarding the Edithvale-Seaford Wetlands is presented in Attachment III *Matters of National Environmental Significance*.

The study area for this assessment was defined on the basis of the potential extent of groundwater mounding/drawdown that was identified by the preliminary groundwater modelling. The GDE study area extends from the coast to approximately 2.5 kilometres inland from the Edithvale and Bonbeach project areas.

Ecological impacts within the project areas are the subject of a separate report (Technical Report D *Ecology: Project Areas*) which is summarised in Section 8.11 of Chapter 8 *Potential local impacts at Edithvale and Bonbeach*.

The key findings presented within this chapter are summarised in Table 6.1.

Table 6.1 Summary of key findings

Topic	Key finding
Edithvale Wetland	Given the distances between the Edithvale Wetland and the project sites (1.3 kilometres from the existing Edithvale Road level crossing and two kilometres from Bonbeach), the works would not directly impact the Wetland through, for example, loss of vegetation or disturbance to bird species. Furthermore, the groundwater modelling predicts that the effect of the trenches on regional groundwater would return to background levels more than one kilometre from the Edithvale Wetland, such that the hydrological regime and ecological character of the Wetland would not be affected. The Edithvale-Seaford Wetlands would therefore continue to meet the applicable Ramsar listing criteria.
Groundwater dependent ecosystems	Terrestrial GDE's exist in a naturally variable environment in which water is accessed via the surface or groundwater. Both sources naturally fluctuate based on long-term climatic conditions and the prevailing weather and as such terrestrial GDE's must be adaptable and resilient to these variable conditions. Given the small change in groundwater predicted through the model it is likely changes to vegetation will be minor or negligible.

6.1 Groundwater dependent ecosystems

GDEs are defined by the Ministerial guidelines for groundwater licensing and protection as: *'those ecosystems that require access to groundwater to meet all or some of their water requirements so as to maintain the communities of plants and animals and ecological processes they support, and ecosystem services they provide'.*

Changes to groundwater have the potential to affect ecosystems that are dependent on it.

GDEs include ecosystems that:

- rely on the surface expression of groundwater such as wetlands and rivers in which groundwater provides at least seasonal waterlogging or inundation
- rely on the availability of water beneath the surface (subsurface).

The degree of the dependence on groundwater of a GDE can vary subject to the availability of alternative sources of water (for example rainfall). Groundwater dependence is also determined by factors including topography, water table depth, vegetation type, geology and groundwater quality, and this dependence can vary on a temporal scale.

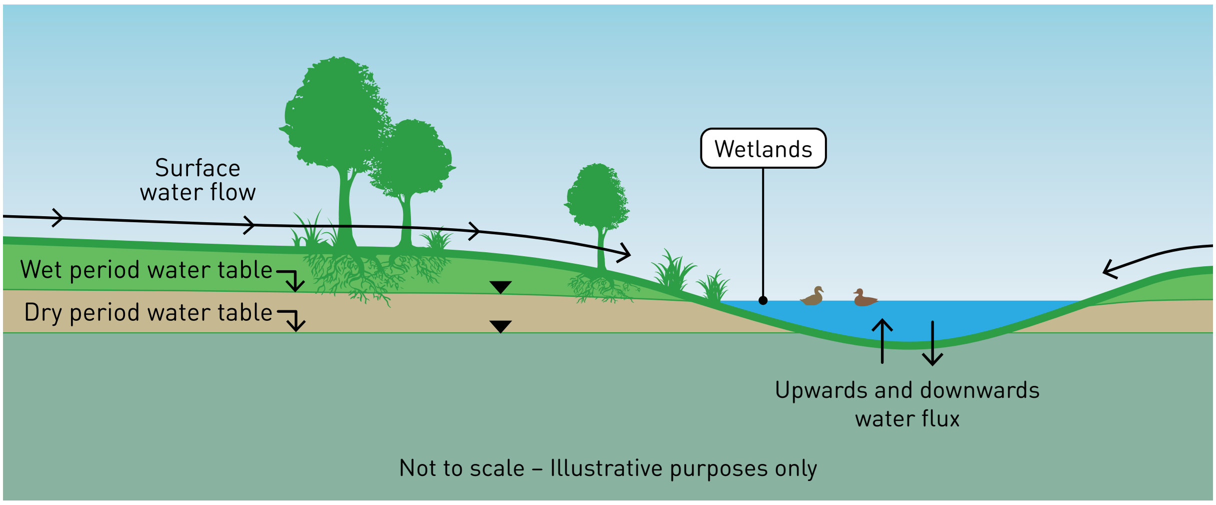
The extent to which a GDE relies on groundwater determines the degree and nature of impact that changes in groundwater quality and quantity may have on the ecosystem.

It is also important to note that a GDE could persist without a permanent groundwater supply. For instance, in years of drought, access to groundwater may not be essential for the long-term survival of a tree, however tree health may decline. With a return to normal rainfall patterns, tree health would recover and the tree would persist.

Refer to Chapter 5 *Modelling the water environment* for further information on how the groundwater modelling has provided the basis for an assessment of the potential impacts on GDEs.

Figure 6.1 provides an overview of the ways that GDEs can interact with groundwater.

Figure 6.1 Groundwater dependent ecosystem


Surface water flow
Wetlands
Wet period water table
Dry period water table
Upwards and downwards water flux
Not to scale – Illustrative purposes only

6.2 Groundwater dependent ecosystems and the level crossings

A number of GDEs were identified within the study area. The most notable of these is the Edithvale-Seaford Wetlands Ramsar site.

Other areas of GDEs identified in the wider Edithvale and Bonbeach area (refer to Figure 6.2 Part A to Part C):

- Wannarkladdin Wetlands
- Area south of Edithvale Wetland (unnamed)
- Edithvale Common
- Rossdale Golf Course
- Chelsea Bicentennial Park
- Beazley Reserve
- Centre Main Drain
- Patterson River
- Patterson River Golf Course
- Aspendale to Carrum Foreshore Reserve
- Residential areas.

These GDEs were identified in the National Atlas of Groundwater Dependent Ecosystems (administered by the Bureau of Meteorology) and/or the Potential Groundwater Dependent Ecosystem Mapping for the Port Phillip and Westernport Catchment Management Authority (administered by DELWP).

An understanding of the existing ecological condition of ecosystems potentially affected by changes to groundwater was critical to inform an assessment of the potential ecological impacts of the level crossing removals. The existing ecological conditions assessment therefore incorporated:

- verification (by field assessment) of the location and type of GDEs identified in the databases and any other potential GDEs not identified during the desktop assessment
- assessment of the ecological value of identified GDEs (based on literature and fieldwork), and in particular whether they are likely to support threatened and/or migratory species listed under the EPBC Act and/or the FFG Act.

The Edithvale-Seaford Wetlands and the Wannarkladdin Wetlands meet the definition of high value GDEs in the *Ministerial Guidelines for Groundwater Licensing and Protection* and, for the reasons set out in Section 6.1, are described in Appendix III *Matters of National Environmental Significance (Edithvale-Seaford Wetlands).*

The Aspendale to Carrum Foreshore Reserve is a largely continuous linear strip of vegetation which is identified by the Kingston City Council as a key natural resource area (areas that contain remnant indigenous vegetation). This vegetation is discussed in Section 6.4 *Aspendale to Carrum Foreshore Reserve*.

The remaining GDEs identified within the study area are discussed in Section 6.7.

Figure 6.2 Part A: GDEs within the study area

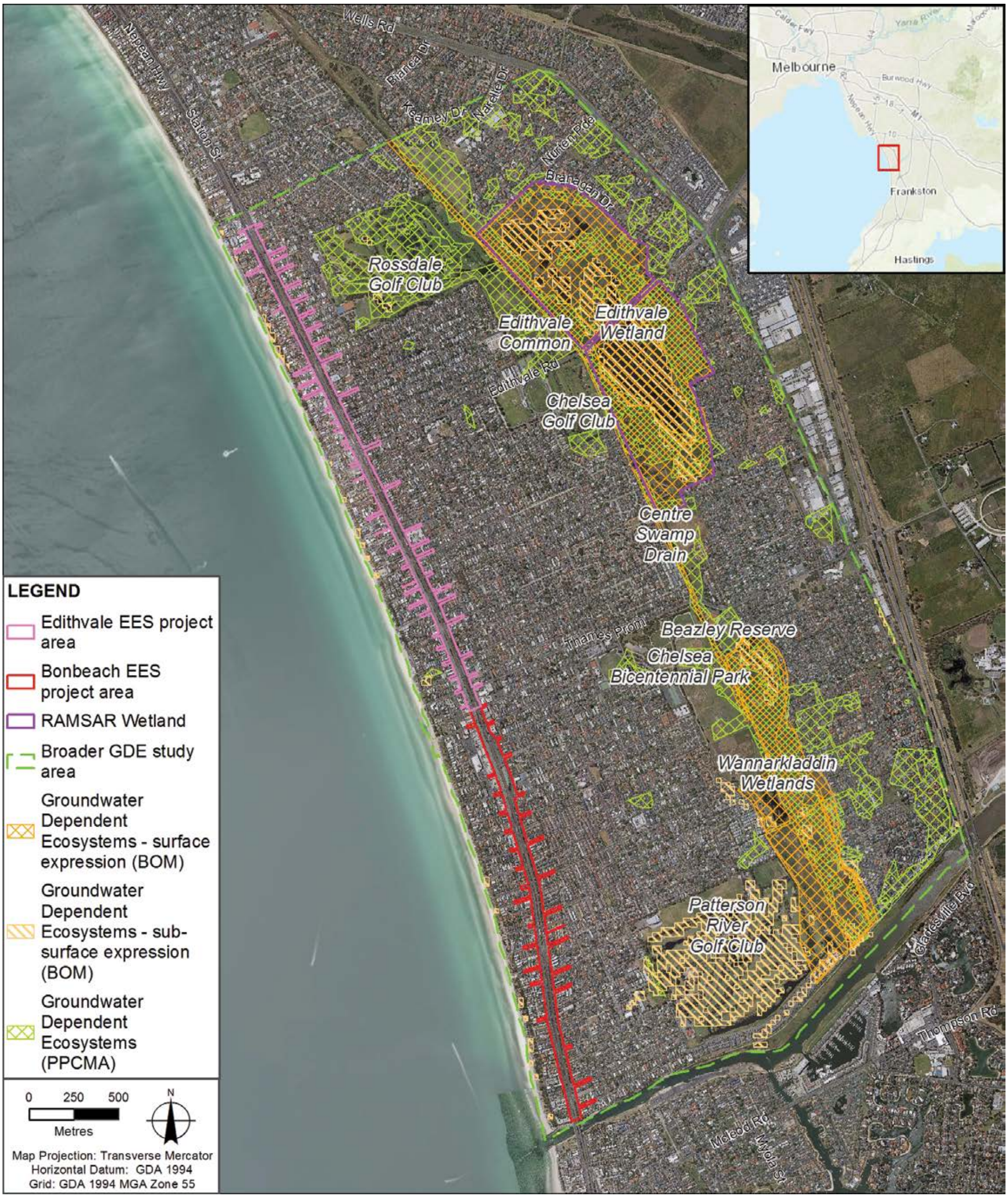


Figure 6.2 Part B: GDEs within the study area

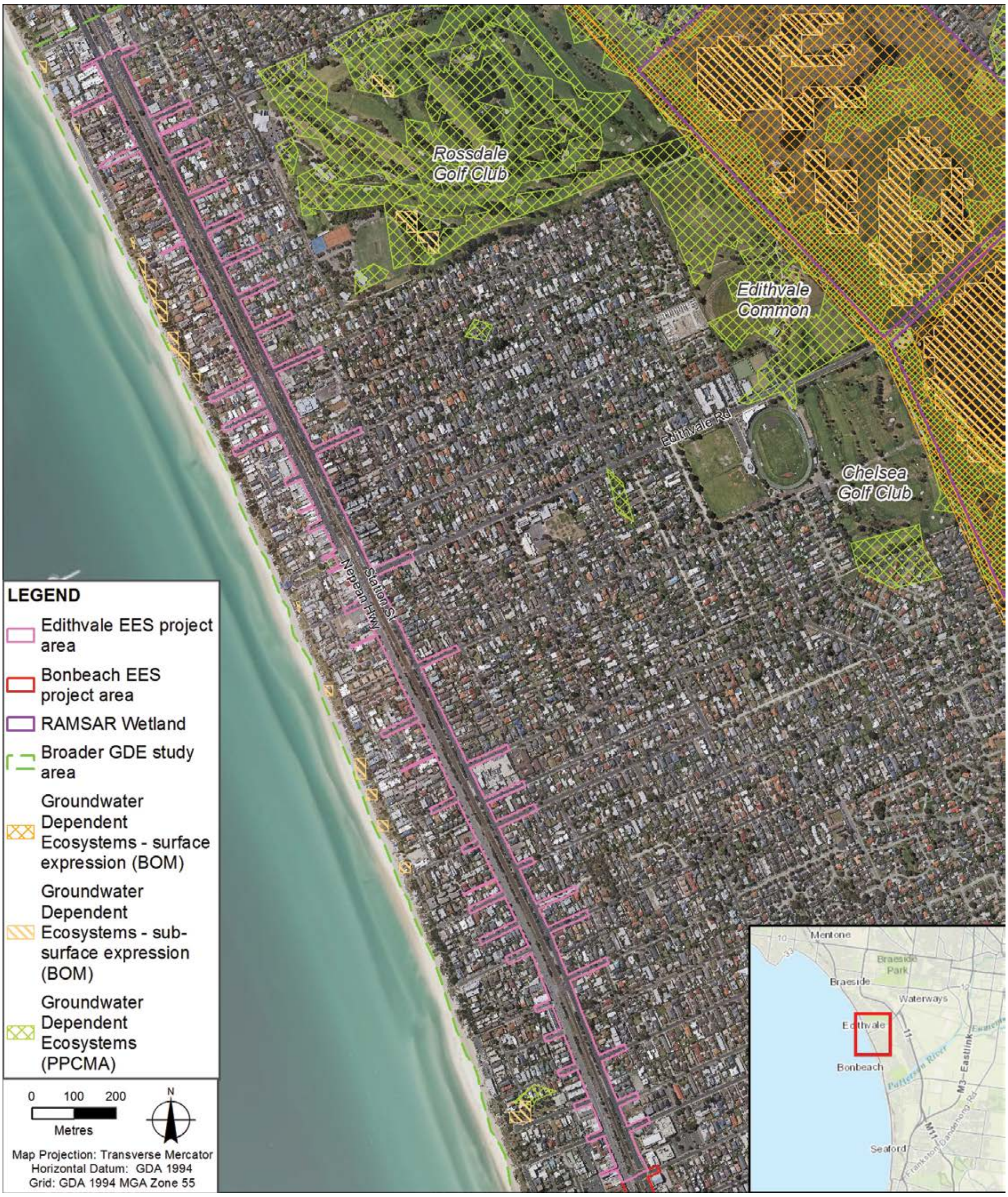
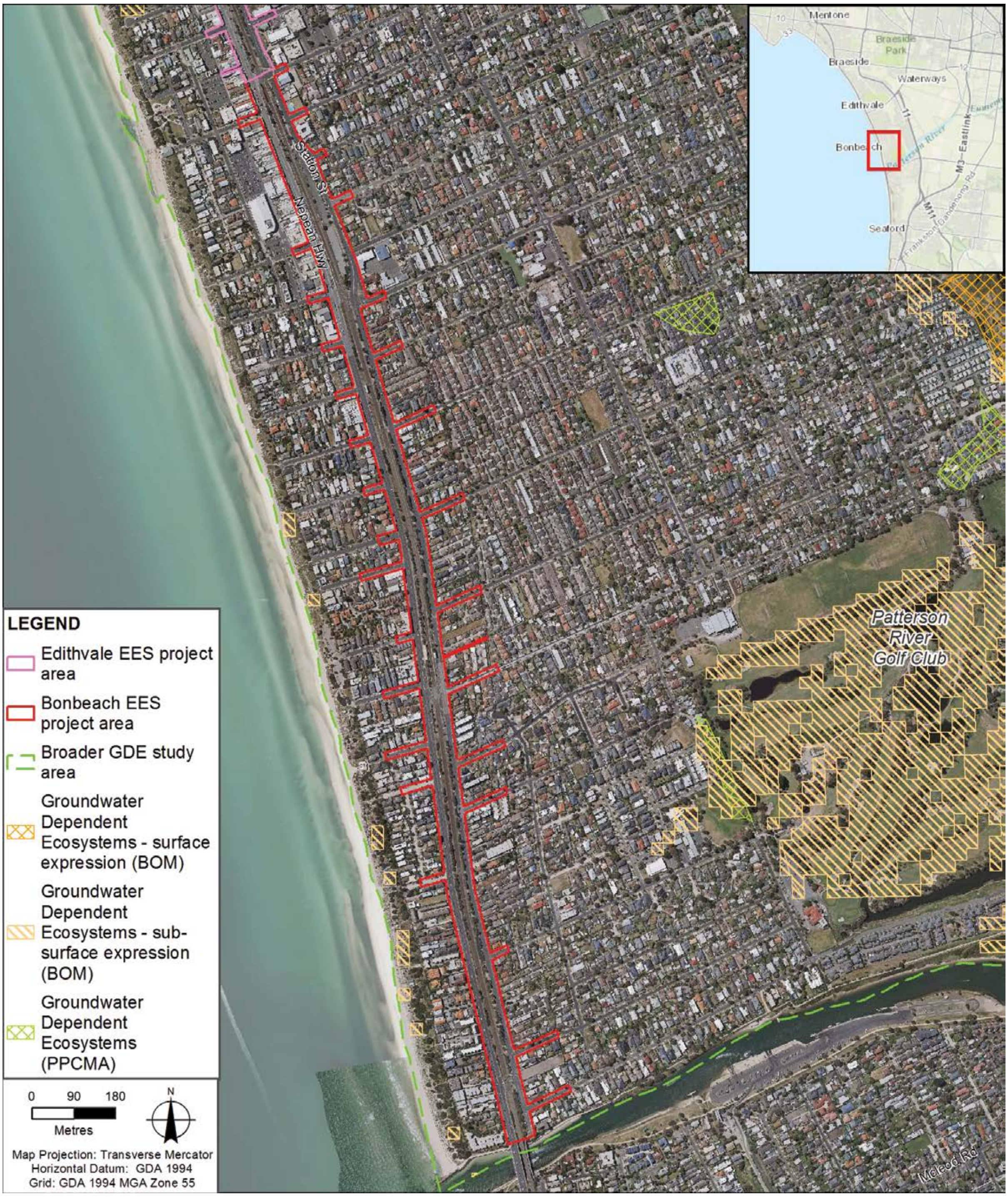

Rossdale Golf Club
Edithvale Common
Edithvale Rd
Chelsea Golf Club
Station St
Nepean Hwy
LEGEND
Edithvale EES project area
Bonbeach EES project area
RAMSAR Wetland
Broader GDE study area
Groundwater Dependent Ecosystems - surface expression (BOM)
Groundwater Dependent Ecosystems - sub-surface expression (BOM)
Groundwater Dependent Ecosystems (PPCMA)
0 100 200
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55
Mentone
Braeside Park
Braeside
Waterways
Edithvale
Bonbeach
Patterson River
M3-Eastlink
M11
Frankston Dandenong Rd
Seaford

Figure 6.2 Part C: GDEs within the study area


Station St
Nepean Hwy
Patterson River Golf Club
McLeod Rd
Mentone
Braeside Park
Braeside
Waterways
Edithvale
Bonbeach
Patterson River
M3-Eastlink
M11
Frankston-Dandenong Rd
Seaford
LEGEND
Edithvale EES project area
Bonbeach EES project area
Broader GDE study area
Groundwater Dependent Ecosystems - surface expression (BOM)
Groundwater Dependent Ecosystems - sub-surface expression (BOM)
Groundwater Dependent Ecosystems (PPCMA)
0
90
180
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

6.3 Methodology

The Edithvale-Seaford Wetlands were the priority for consideration in the impact assessment, given the significance of its Ramsar listing and its proximity to the project sites.

To understand the potential for ecologically significant GDEs to be impacted by project induced changes to groundwater, the following areas were considered as part of the ecological assessment:

- the hydrological regimes within identified GDEs and their dependency on, and relationship to, groundwater
- the nature and extent of regional groundwater impact
- the consequence of any change in the relationship between the GDEs and groundwater, and the subsequent impact this may have on the ecological values they support.

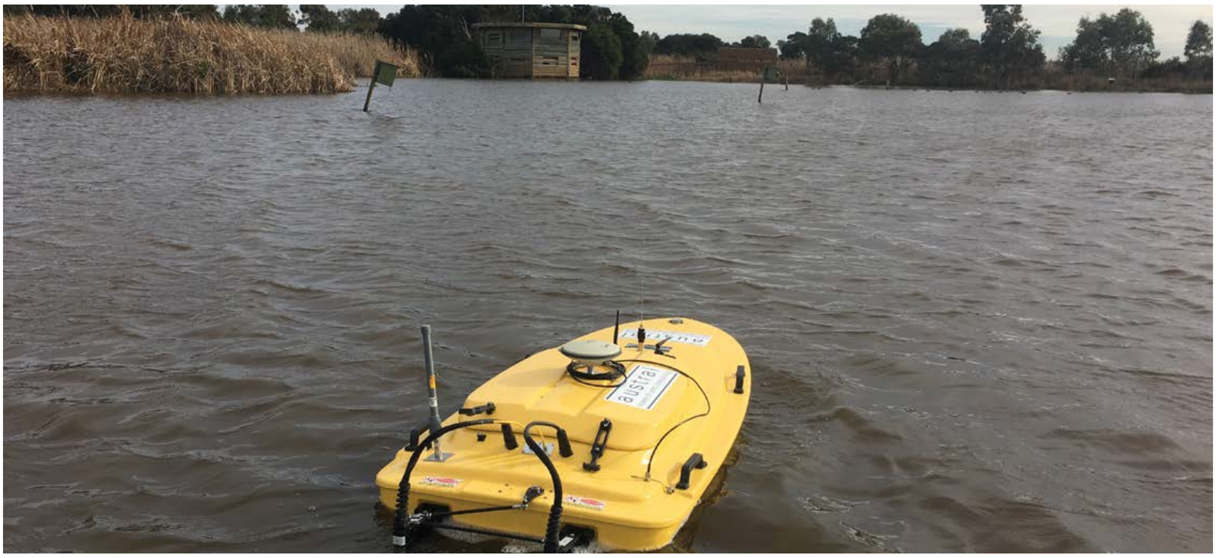
Edithvale Wetland and Seaford Wetland form two discrete wetland systems which are physically distinct and are separated by the Patterson River (Technical Report A *Groundwater*), but are both incorporated within the same Ramsar site listing. As such, the Seaford Wetland would not be impacted by the Edithvale and Bonbeach level crossing removals, and the focus of this assessment is therefore on the Edithvale Wetland section of the Edithvale-Seaford Wetlands.

For other GDEs within the study area, the potential to support state and nationally significant ecological values was also considered as part of the impact assessment.

Ecological investigations that were undertaken concurrently with the groundwater and surface water modelling to inform the assessment of potential consequences of groundwater and/or surface water change on the ecological values of GDEs within the study area included:

- A review of key literature pertaining to GDEs in the study area, with particular reference to the Edithvale-Seaford Wetlands Ramsar site management plan and ecological character description (including the 2017 addendum) and a report on the natural values of the Kingston Foreshore Reserve.
- Aerial photographic interpretation to map the key habitat features that are likely to be preferred by significant wildlife at the Edithvale Wetland (mud flats, reed beds and open water).
- Bathymetric survey to establish a detailed depth profile of each of the cells of the wetland and allow a theoretical water volume of each cell to be determined. This was undertaken in July 2017 using a remote-controlled boat that uses sonar to measure water depth (as shown in Figure 6.3).
- Aquatic fauna survey to identify the diversity, abundance and distribution of invertebrates as a food source for priority wading birds and the presence and diversity of fish (including searches for the nationally significant Dwarf Galaxias).
- Analysis of BirdLife Australia data from bird surveys since 1987 to determine the types of species, their abundance and the period of occupancy of the key GDEs in the study area. Analysis focused on Edithvale Wetland and the key species of Sharp-tailed Sandpiper, Curlew Sandpiper, Australasian Bittern and Latham's Snipe.
- Assessment of the likelihood of occurrence of threatened and/or migratory species within the study area. Habitat requirements were compared to existing conditions of the study area and a precautionary approach taken to their likelihood of occurrence.
- Vegetation assessments were undertaken at Edithvale Wetland in July 2017 to understand the current extent of vegetation and the condition of the vegetation. The vegetation assessment included mapping native vegetation and conducting vegetation quality assessments of native vegetation patches by applying the DELWP habitat hectare assessment method.
- Climate data (dating from 1950) was obtained from the Bureau of Meteorology (SILO data at station 86210 Bonbeach Carrum) to gain an understanding of whether seasonal variation in the abundance and diversity of key bird species at the Edithvale Wetland is influenced by rainfall and temperature.

Figure 6.3 The boat used to collect bathymetry data in the Wetlands



6.4 Edithvale-Seaford Wetlands

6.4.1 Existing conditions

The Edithvale-Seaford Wetlands are located approximately 30 kilometres south east of Melbourne. The wetlands are regionally and internationally significant, providing habitat for a diversity of threatened and/or migratory birds.

The Edithvale-Seaford Wetlands are remnant of what was once the Carrum Carrum Swamp, a shallow freshwater swamp that was largely drained in the late nineteenth century to reclaim land for agriculture and housing. In 1974 the area was protected by the then Dandenong Valley Authority due to the potential for the wetlands' capacity to process floodwaters in the area.

The Edithvale-Seaford Wetlands are used for conservation, recreation and education purposes and provide open space that is highly valued by the community. The Edithvale-Seaford Wetland Education Centre was established at Edithvale Wetland in recognition of its ecological value. The Education Centre is managed by Melbourne Water and is highly utilised, offering tailored education programs for students of all levels. A bird hide was established at Edithvale for members of the public and researchers to observe wildlife within the Edithvale-Seaford Wetlands.

The Edithvale-Seaford Wetland was listed as a wetland of international importance under the Ramsar Convention in August 2001. For a wetland to be listed under the Ramsar Convention it must satisfy one or more of the criteria for identifying wetlands of international importance. The Ramsar criteria related to the Edithvale-Seaford Wetlands are outlined in Attachment III *Matters of National Environmental Significance*.

In addition to the Ramsar listing, the Edithvale-Seaford Wetlands are also recognised as:

- a wetland of national importance in the Directory of Important Wetlands in Australia
- a Matter of National Environmental Significance (MNES) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) by virtue of the Ramsar listing
- a site recognised to be internationally important for shorebird conservation in the East Asian – Australasian Flyway (EAAF)
- part of the Carrum Wetland Key Biodiversity Area program led by BirdLife Australia.
- a site of State and International Treaty Zoological Significance in the south east of Melbourne and Mornington Peninsula (identified by DSE in 2004)
- identified as a high value site of biodiversity significance by Melbourne Water
- an area of environmental significance subject to an Environmental Significance Overlay under the Kingston Planning Scheme.

What are Ramsar wetlands?

A Ramsar wetland is a wetland that has been designated under Article 2 of the Ramsar Convention, or which has been declared by the Federal Environment Minister to be a Ramsar wetland under the EPBC Act.

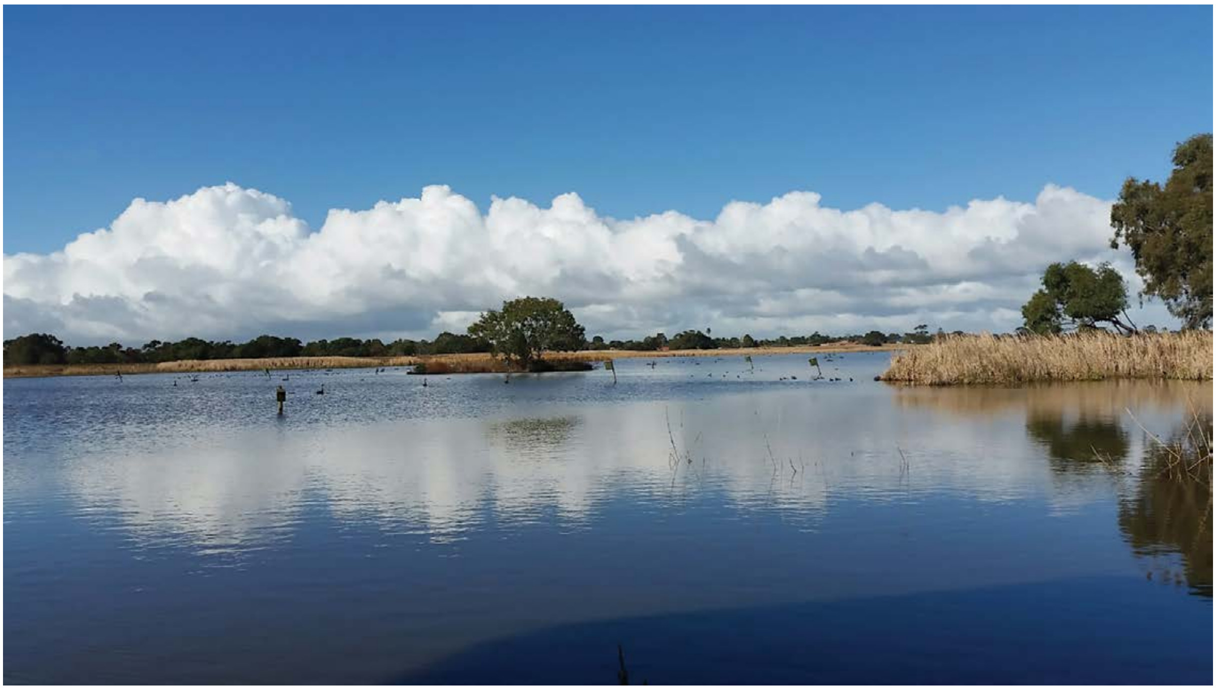
The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity.

Once designated, these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites.

In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use. Wise use under the Convention is broadly defined as maintaining the ecological character of a wetland.

For further information on Ramsar wetlands visit www.environment.gov.au.

Figure 6.4 Edithvale Wetland viewed from the bird hide



6.4.2 Impact assessment

The groundwater and surface water assessments undertaken for the EES have demonstrated that changes to the hydrological regime at the Edithvale-Seaford Wetlands are not predicted.

In particular, groundwater mounding is not modelled to occur closer than 1,000 metres away from the Edithvale Wetland section of the Ramsar site. As a result, there is negligible risk of an impact on the Edithvale-Seaford Wetlands from the projects. Chapter 5 *Modelling the water environment* provides detail on this finding.

In light of this, a separate attachment (Attachment III *Matters of National Environmental Significance)* is provided that discusses the wetlands and their importance as a Matter of National Environmental Significance and the impact and risk assessment that has been undertaken in relation to the wetlands.

Attachment III *Matters of National Environmental Significance* also responds to Section 4.2 of the Scoping Requirements, which requires an assessment of the ecological character of the Edithvale Wetland and any potential impacts of the projects.

For ease of reference, the findings of the risk assessment for the Edithvale-Seaford Wetlands are presented below:

Construction

No risks were identified during the construction phase of the Edithvale and Bonbeach level crossing removal projects in relation to the Edithvale Wetland and GDEs, given the significant distance between the level crossing sites and the wetlands. Refer to Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems* for further information.

Operation

The initial and residual risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects in relation to the Edithvale Wetland and GDEs are outlined in Table 6.2.

Table 6.2 Edithvale Wetland risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
EG72	Edithvale-Seaford Wetland Ramsar Site (Edithvale)	Groundwater mounding resulting in altered hydrological regime and/or water quality leading to a change in ecological character (habitat and/or food availability) that exceeds the limit of acceptable change for critical components, processes and systems to the extent that the Edithvale-Seaford Wetlands no longer meet criteria for listing as a Ramsar site.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 – GDE Monitoring and Mitigation Plan (Edithvale Wetland)	Negligible
EG73	Listed migratory and threatened species	Groundwater mounding leading to an altered hydrological regime and resulting in change in habitat (wet grassland / mudflats) at Edithvale Wetland to the extent that the site no longer regularly supports listed migratory and threatened bird species. Species include Sharp-tailed Sandpiper Latham's Snipe, Australian Bittern and Curlew Sandpiper.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 – GDE Monitoring and Mitigation Plan (Edithvale Wetland)	Negligible

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
EG74	Native vegetation (Edithvale)	Groundwater mounding resulting in altered hydrological regime and/or water quality resulting in loss of native vegetation (patches and scattered trees) within Edithvale Wetland leading to a reduction in the extent of native vegetation in Victoria.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 – GDE Monitoring and Mitigation Plan (Edithvale Wetland)	Negligible
EG75	Exacerbate sea level rise (Edithvale)	Groundwater mounding resulting in altered hydrology exacerbates or accelerates predicted effects of sea level rise (climate change) resulting in a loss of habitat and change in ecological character of Edithvale Wetland resulting in failure to meet the Limits of Acceptable Change (LAC) for critical components, processes and services (CPS) and/or Ramsar listing criteria.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes	Negligible
EG76	Threatening process – wetland loss (Edithvale)	Loss of Edithvale Wetland resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes	Negligible

Management approach

The EPRs developed for the project recognise the significance of the Edithvale-Seaford Wetlands as a critically important environmental asset. In recognition of the importance of this asset, and despite the negligible risk that the project is considered to pose to this asset, a management approach has been developed and would be implemented.

A Groundwater Management and Monitoring Plan (EPR reference GW3) would be developed prior to commencement of construction. The Groundwater Management and Monitoring Plan would include:

- detailed monitoring parameters including timing and location of groundwater monitoring bores
- duration of the monitoring program
- clear trigger levels for changes in groundwater level and quality that would require mitigation plans to be developed and implemented.

A Groundwater Dependent Ecosystem Monitoring and Mitigation Plan for the Edithvale-Seaford Wetlands would be developed in consultation with Melbourne Water (EPR reference FF8). The Plan would only be implemented if the trigger levels for changes to groundwater level and quality that are detailed in the Groundwater Management and Monitoring Plan are met.

This plan would include:

- monitoring of groundwater and surface water level and quality at representative and strategic locations within and around the Edithvale Wetland
- the frequency and duration of monitoring if required
- monitoring of surface water quality at representative and strategic locations within the wetlands to differentiate temporal trends from long term changes to groundwater if required
- criteria (levels and quality) for groundwater and surface water change in and around the Edithvale Wetland to allow for the determination of whether a change in groundwater levels and/or quality is attributable to the projects
- response measures to implement in the event groundwater and surface water change criteria are met, such as:
  - a process for ecological assessment developed by a suitably qualified ecologist to assess changes in aquatic and terrestrial fauna and flora, and consider whether these can be attributable to groundwater or surface water changes
  - criteria for determining whether a change in the extent or condition of the wetlands is attributable to the projects
  - contingency measures that would be implemented to mitigate potential impacts attributable to the projects
  - include the frequency and duration of monitoring.

6.5 Wannarkladdin Wetlands

6.5.1 Existing conditions

Wannarkladdin Wetlands are ecologically similar to Edithvale Wetland, however they are not listed as a Matter of National Environmental Significance (MNES). They are dominated by Tall Marsh Ecological Vegetation Classes (EVC) (refer Figure 6.5) and support a number of wetland cells which range from deep pools surrounded by dense reed beds (Wannarkladdin West, refer Figure 6.6) to shallow open water and bare soil or mud (Wannarkladdin East, refer Figure 6.7). The Wannarkladdin Wetlands provide a mosaic of permanent and semi-permanent habitat for a number of waterbirds and shorebirds (in low abundance).

Vegetation and habitat

Three EVCs are recorded in the Wannarkladdin Wetlands:

- **Tall Marsh (EVC 821)** – fringes the waterbodies and covers extensive areas throughout the Wannarkladdin Wetlands.
- **Brackish Wetland (EVC 656)** – appears as unvegetated open water/bare soil/mud (EVC 990) for approximately six months of the year.
- **Brackish Aquatic Herbland (EVC 537)** – occurs in semi-permanent to seasonal wetlands and is dominated by aquatic herbs.

Ecological Vegetation Class (EVC)

In Victoria, patches of remnant vegetation are classified by an Ecological Vegetation Class (EVC) which are based on the general ecological characteristics and underlying geology of the vegetation.

Remnant vegetation includes patches both of native vegetation and scattered indigenous trees. The removal of remnant vegetation is controlled through the application of the Permitted clearing of native vegetation Biodiversity Assessment Guidelines an incorporated document under the Planning and Environment Act 1987. Refer to Attachment III *Matters of National Environmental Significance* for further information.

Figure 6.5 Tall Marsh and mown non-native areas – Wannarkladdin Wetlands north (June 2017)

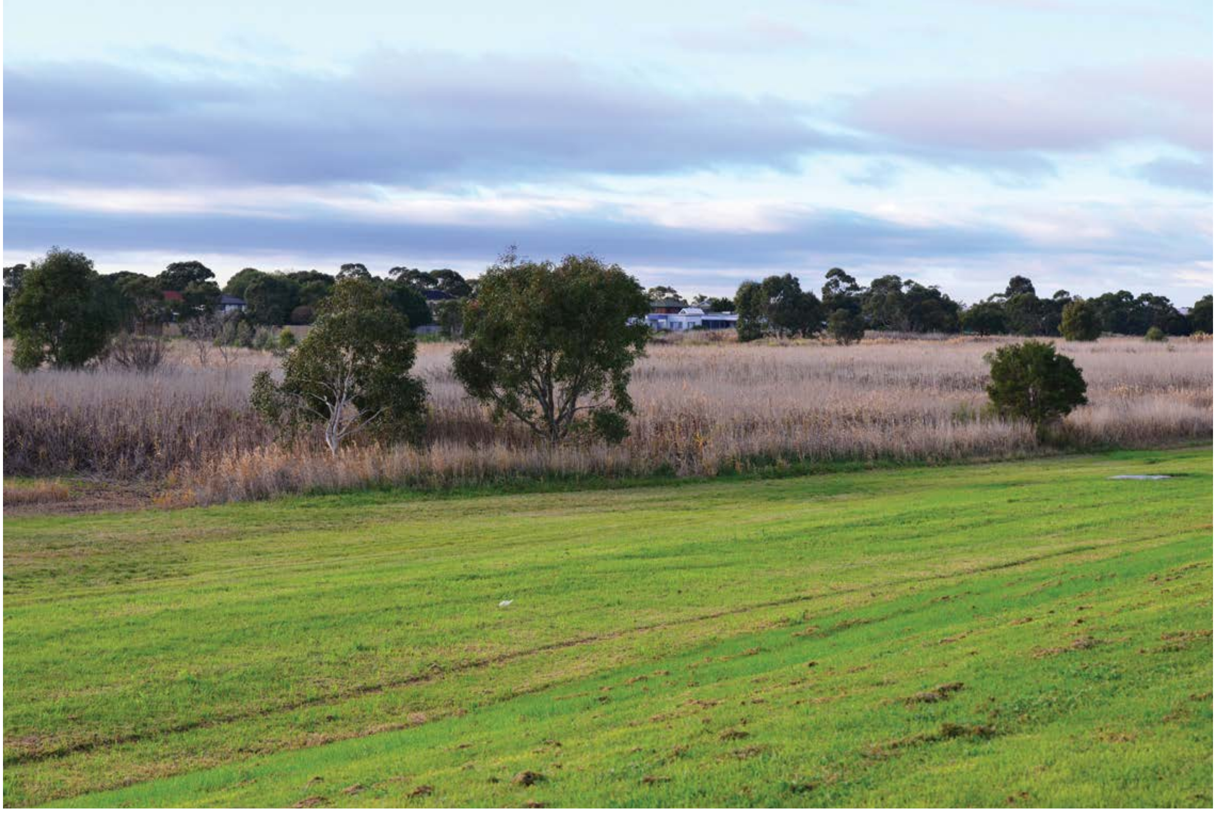


Figure 6.6 Deeper pool – Wannarkladdin Wetlands west (June 2017)

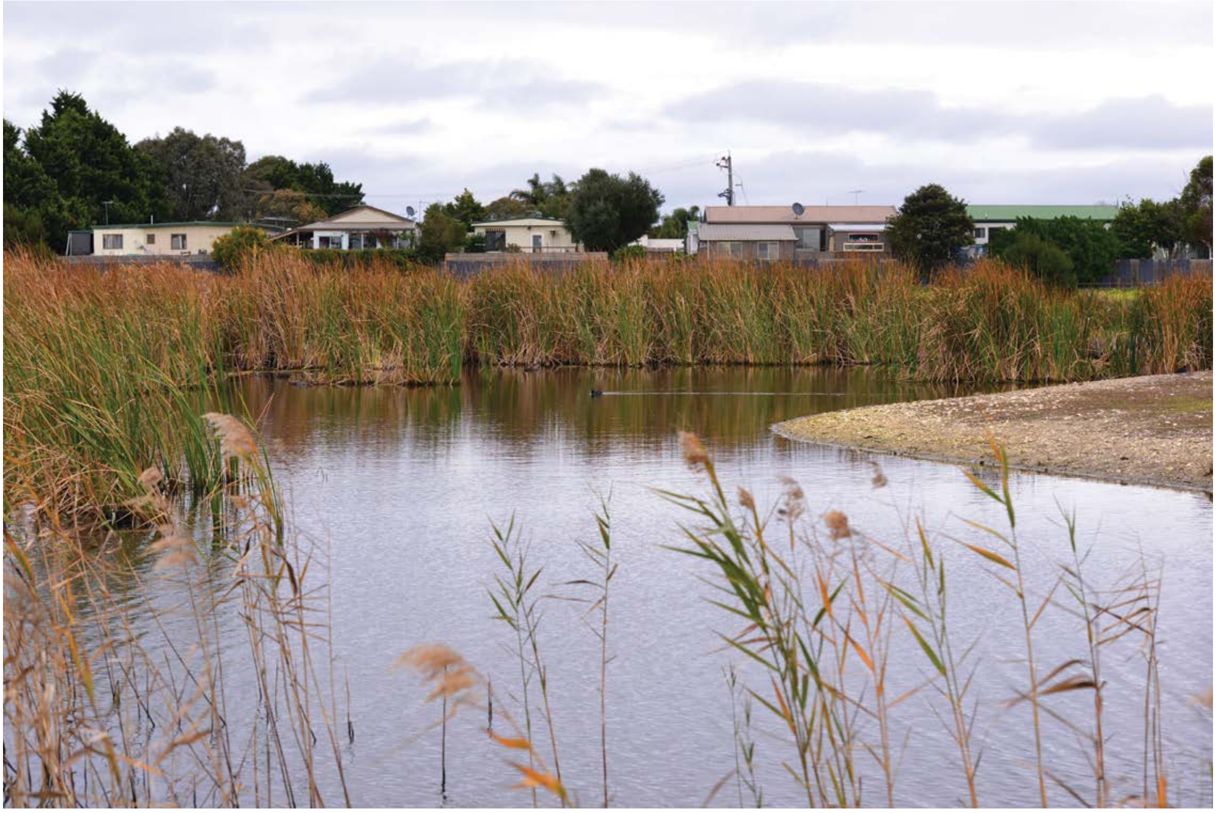
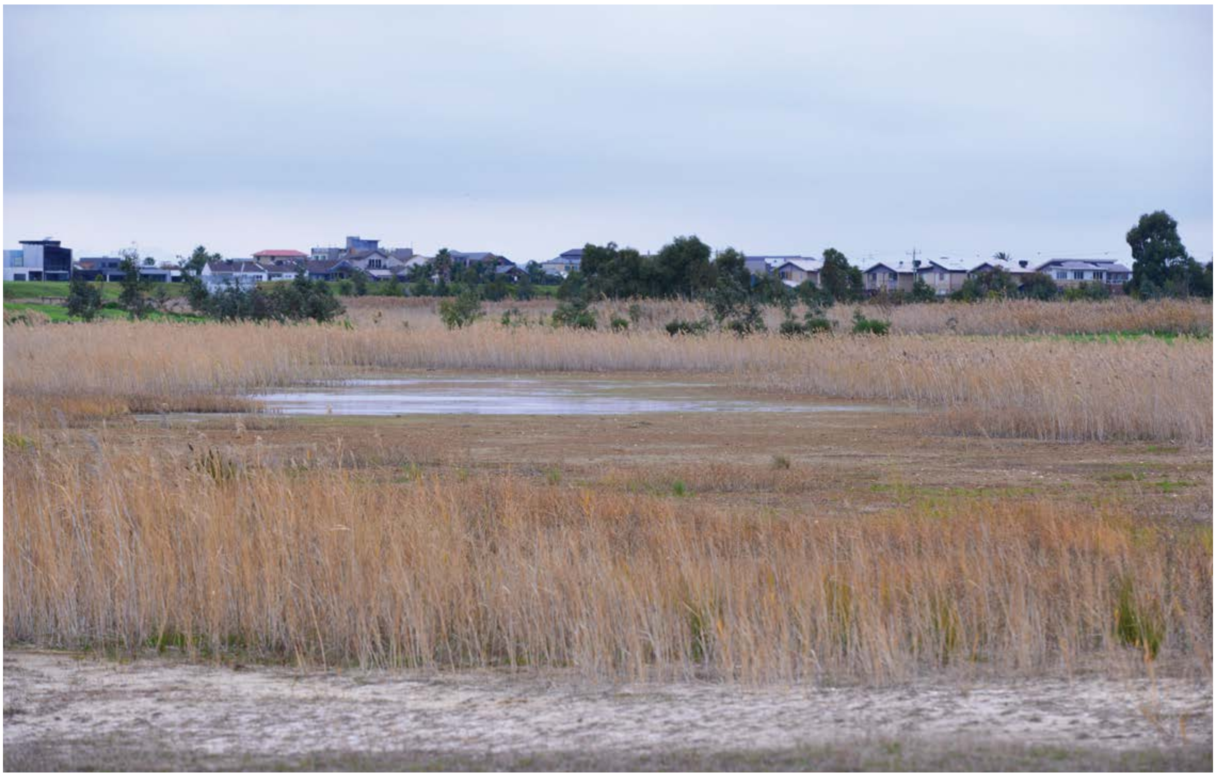


Figure 6.7 Semi-permanent wetland – Wannarkladdin Wetlands east (June 2017)



Threatened and/or migratory birds

BirdLife Australia has been monitoring birds (and other animals on an incidental basis) at the Wannarkladdin Wetlands since 2013. Based on analysis of BirdLife Australia data, Wannarkladdin Wetlands is known to provide habitat for 10 threatened and/or migratory birds:

- Australasian Shoveler
- Blue-billed Duck
- Caspian Tern
- Great Egret
- Hardhead
- Intermediate Egret
- Latham's Snipe
- Little Egret
- Musk Duck
- Sharp-tailed Sandpiper.

All species were recorded in low abundance and habitat appears more important for threatened duck species than migratory shorebirds. Latham's Snipe is the only exception to this.

What is a threatened species?

'Threatened species' refers to those species that are considered 'threatened' in Victoria or Australia. This includes species that are listed as:

- 'threatened' under the *Flora and Fauna Guarantee Act 1988*;
- 'vulnerable', 'endangered' or 'critically endangered' on the Victorian Rare or Threatened species advisory lists; or
- 'vulnerable', 'endangered' or 'critically endangered' under the *Environment Protection and Biodiversity Conservation Act 1999*.

Threatened plants

River Swamp Wallaby-grass and Swamp Everlasting (both listed under the EPBC Act), Pale Swamp Everlasting (vulnerable in Victoria) and Lacey River Buttercup (rare in Victoria) have a moderate likelihood of occurring at Wannarkladdin Wetlands. However, like Edithvale Wetland, the growth of both indigenous and exotic graminoid (herbaceous, grass-like) plants is the biggest limiting factor for the persistence of threatened plant species. In particular, the prolific growth of Common Reed, Narrow-leaf Cumbungi and Broad-leaf Cumbungi is likely encouraged by stormwater inflows which carry sediments and nutrients from the surrounding residential developments. Access to the wetlands is unrestricted, and the site is within close proximity to residential subdivisions, which is likely to exacerbate weed spread.

6.5.2 Impact assessment

Construction

An assessment of risks and impacts to groundwater posed by the projects was undertaken in accordance with the method described in Chapter 4 *Assessment framework*. No risks were identified during the construction phase of the Edithvale and Bonbeach level crossing removal projects, in relation to the Wannarkladdin Wetlands and GDEs, given the significant distance between the level crossing sites and the wetlands. Refer to Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*.

Operation

The initial and residual risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects in relation to the Edithvale Wetland and GDEs are outlined in Table 6.3.

Table 6.3 Wannarkladdin Wetlands risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
EG80	Wannarkladdin Wetland (Bonbeach)	Groundwater mounding resulting in altered hydrological regime and/or water quality resulting in loss of native vegetation and/or fauna habitat associated with Wannarkladdin Wetland	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Negligible
EG82	Threatening process – wetland loss (Bonbeach)	Loss of Edithvale Wetland and/or Wannarkladdin Wetland, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes	Negligible

No change to water levels is predicted to occur at Wannarkladdin Wetlands (refer to Chapter 5 *Modelling the water environment*) with groundwater mounding not expected to extend closer than 1,500 metres toward Wannarkladdin Wetlands.

In the highly unlikely event that there was an increase in groundwater level as a result of the projects, related impacts are unlikely to be significant in the context of existing risks which are already exerting pressure on the wetland's ecological values. While Wannarkladdin Wetlands is considered to be a high quality GDE on the basis that it provides habitat for threatened and/or migratory birds, it is not specifically managed for the purposes of conservation.

Access to the wetlands by the public, as well as domestic animals is unregulated and no fencing exists to exclude pest animals. Impacts to surface water quality (through stormwater runoff), weed spread and predation and disturbance by domestic and/or pest fauna all pose a greater risk to the wetlands than that posed by the level crossing removal projects. The risk of altered hydrological regime and/or changes to groundwater quality resulting in loss of native vegetation and/or fauna habitat associated with Wannarkladdin Wetland is considered to be negligible.

6.6 Aspendale to Carrum Foreshore Reserve

6.6.1 Existing conditions

The Aspendale to Carrum Foreshore Reserve is a largely continuous and linear strip of vegetation which is identified as a key natural resource area by the Kingston City Council (that is, an area that contains remnant indigenous vegetation).

The importance of the foreshore as an environmental asset is recognised in Section 21.08 of the Kingston Planning Scheme, which aims to protect the foreshore for future generations and, where possible, restore natural ecosystems and minimise adverse environmental impacts. The establishment of a 'friends group' to help manage and revegetate the reserve at Bonbeach highlights the importance of this area for the local community.

One Coast Banksia in the foreshore reserve near the end of The Glade, Bonbeach is listed as a significant tree under Schedule 3 of the Environmental Significance Overlay of the Kingston Planning Scheme.

Vegetation and habitat

The reserve is characterised by three EVCs:

- **Coast Banksia Woodland (EVC 2)** – this EVC is patchily distributed along the foreshore reserve, typically near the eastern edge adjacent to the residential area. Few large Banksias persist in the foreshore reserve (refer Figure 6.8).
- **Coastal Dune Scrub (EVC 160)** – this EVC forms a semi-continuous linear strip of vegetation which is primarily located on the top of and towards the back of the dune (refer Figure 6.9).
- **Coastal Dune Grassland (EVC 879)** – this EVC also forms a semi-continuous linear strip, primarily along the foredune (refer Figure 6.10).

The vegetation within the foreshore reserve is considered to be of moderate to high quality and is more intact around Bonbeach than it is around Edithvale. Coast Tea-tree is the dominant species within the reserve and its ability to flourish in this dynamic landscape had resulted in a number of the more sensitive understorey species being out-competed. Recent targeted weed control and revegetation work has significantly increased the species diversity and hence the quality of this vegetation.

The foreshore vegetation provides habitat for a range of non-threatened fauna species and forms a wildlife corridor through the landscape, particularly for birds. The reserve does not support any biodiversity values that are protected as a MNES under the EPBC Act.

The remnant vegetation in the foreshore reserve is likely to be accessing groundwater (as discussed in Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*). The extent to which the vegetation is dependent on groundwater for survival is unknown, but it is likely that the vegetation within this GDE also utilises rainfall to meet its water requirements. The potential rooting depths of the dominant plants within the foreshore reserve vegetation range from up to 15 metres for Coast Banksia and up to 2.5 metres for Hairy Spinifex, but are likely to be influenced by existing groundwater levels and possibly other factors such as substrate permeability and groundwater quality. Figure 6.11 illustrates the respective root depth capabilities of these plants.

Figure 6.8 Coast Banksia Woodland in the coastal reserve at Bonbeach

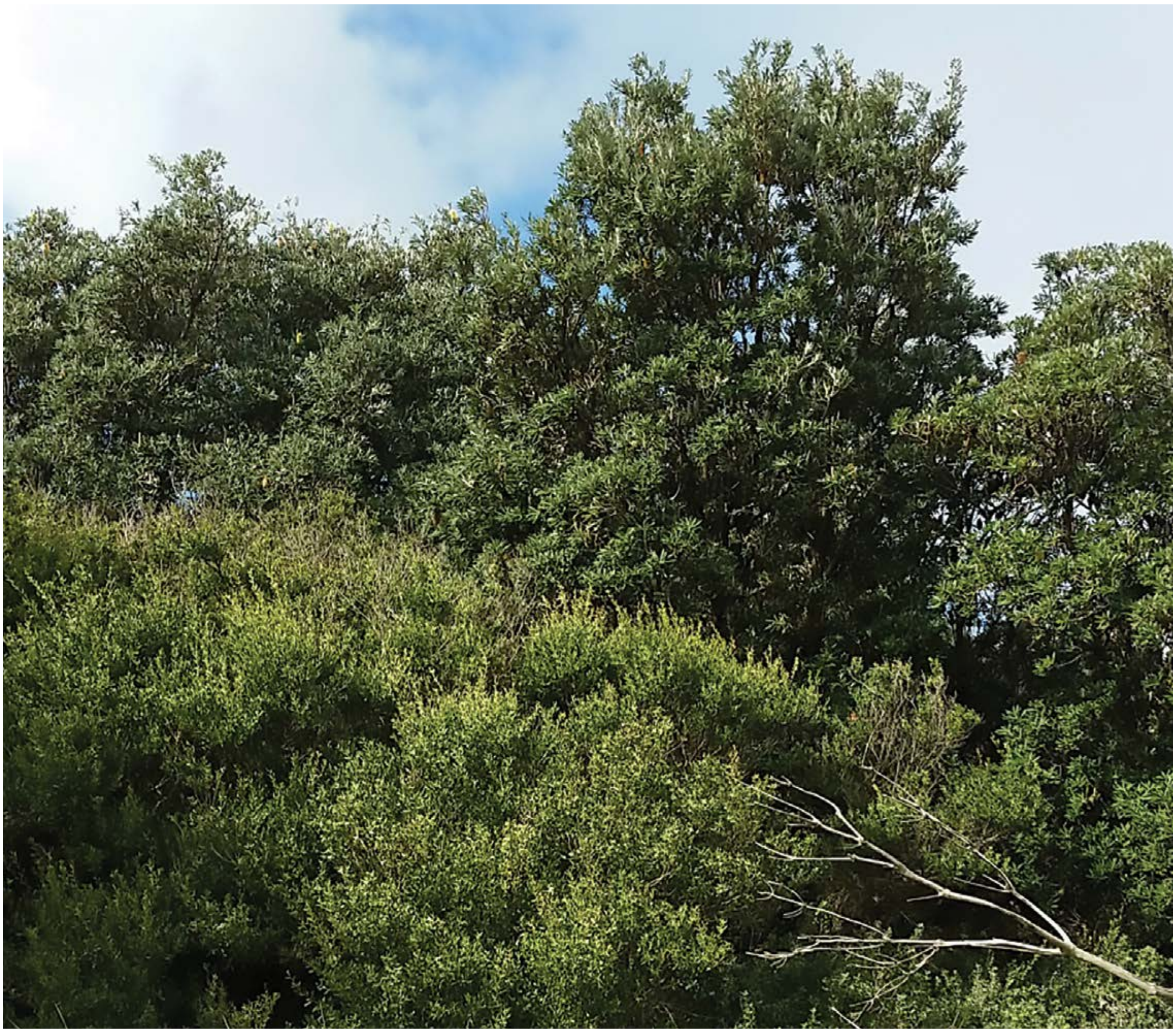


Figure 6.9 Coast Dune Scrub in the foreshore reserve at Bonbeach

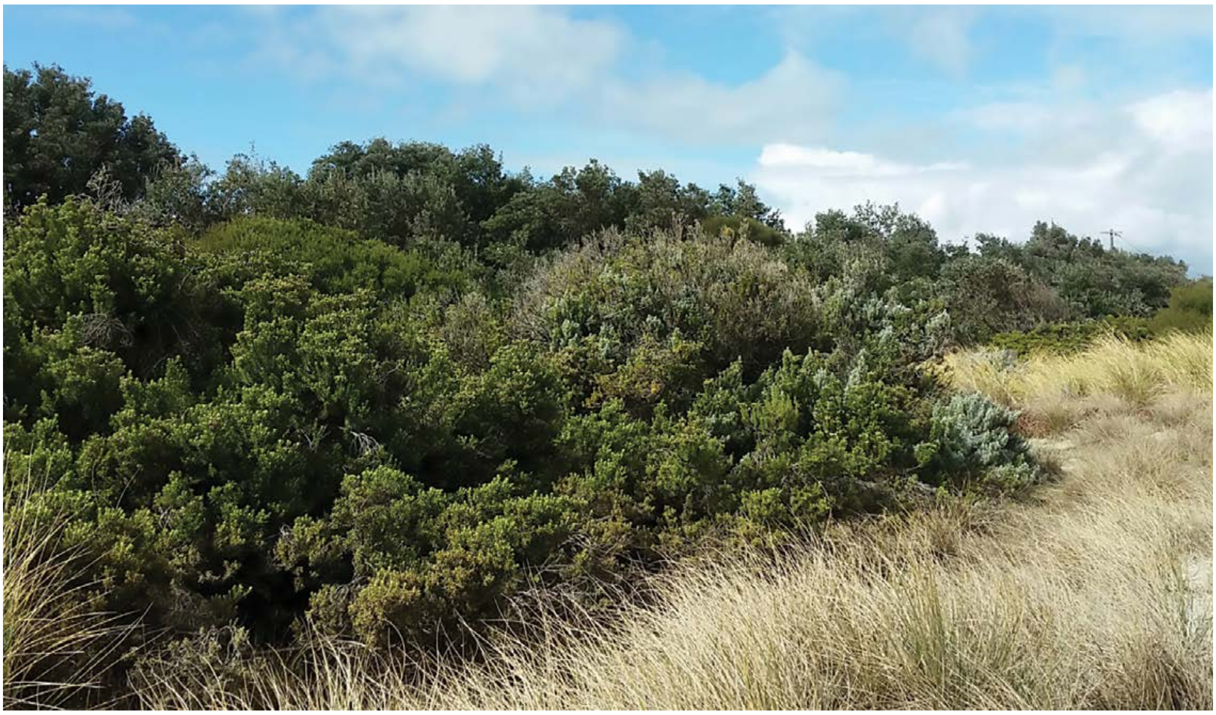
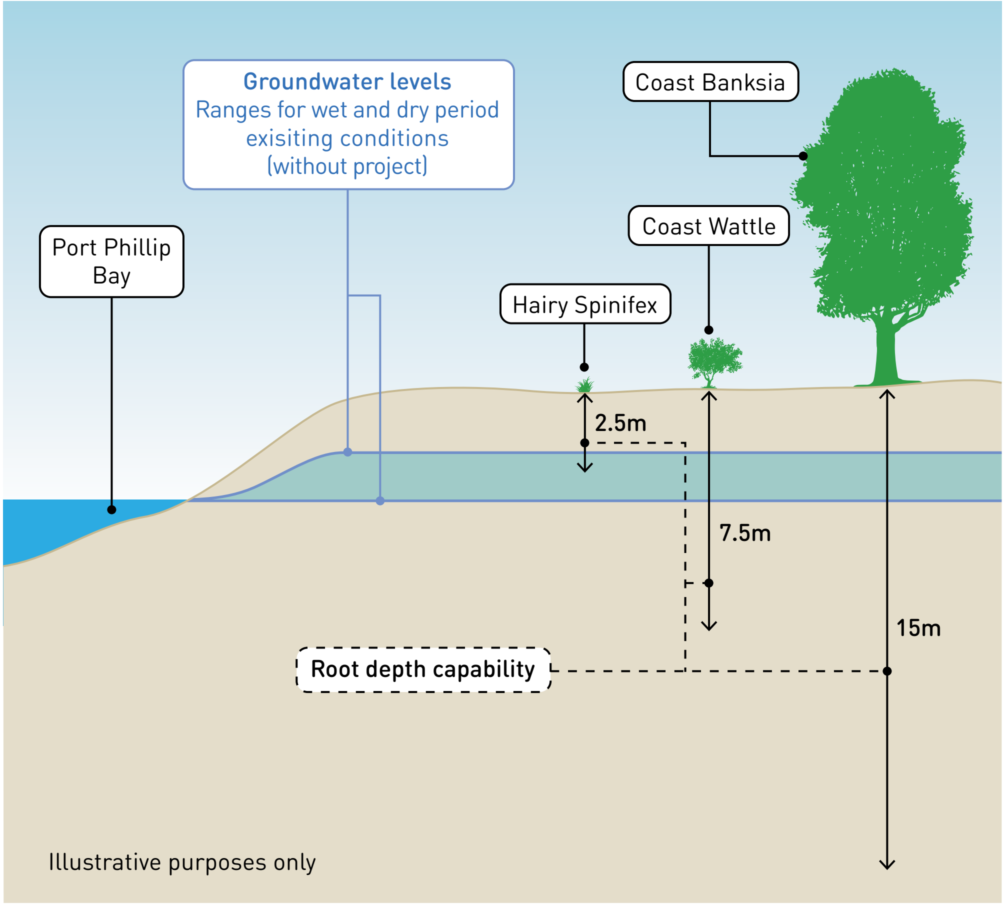


Figure 6.10 Coastal Dune Grassland

Figure 6.11 Indicative root depth capability of foreshore coastal vegetation relative to existing groundwater levels



Threatened and/or migratory animals

The habitat of the foreshore reserve is considered unlikely to support threatened species given its proximity to residential areas and its history of disturbance. Some highly mobile species may occur on a rare and occasional basis.

Threatened plants

The foreshore reserve is not known to contain any threatened plants nor are any threatened species considered to have a moderate or above likelihood of occurrence.

6.6.2 Impact assessment

Construction

No risks were identified during the construction phase of the Edithvale and Bonbeach level crossing removal projects, in relation to the Aspendale to Carrum Foreshore Reserve and GDEs. This is due to the significant distance between the level crossing sites and the reserve. Refer to Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*.

Operation

The initial and residual risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects, in relation to the Edithvale Wetland and GDEs are outlined in Table 6.4.

Table 6.4 Aspendale to Carrum Foreshore Reserve risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
Edithvale						
EG77	Coastal reserve – native vegetation (Edithvale)	Groundwater drawdown resulting in the loss of native vegetation and fauna habitat along the coastal reserve leading to a reduction in the extent of native vegetation in Victoria and increased risk of erosion of the foreshore.	EPR GW1 – Rail trench design EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Minor	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Negligible
EG78	Threatening process – habitat fragmentation (Edithvale)	Fragmentation of the narrow habitat corridor of the foreshore reserve, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 – Rail trench design EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Negligible

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
Bonbeach						
EG83	Coastal reserve – native vegetation (Bonbeach)	Groundwater drawdown resulting in the loss of native vegetation and fauna habitat along the coastal reserve leading to a reduction in the extent of native vegetation in Victoria and increased risk of erosion of the foreshore.	EPR GW1 – Rail trench design EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Minor	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation) EPR CL5 – Groundwater Acidification and Contamination Mitigation Plan	Minor
EG84	Threatening process – habitat fragmentation (Bonbeach)	Fragmentation of the narrow habitat corridor of the foreshore reserve, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 – Rail trench design EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 – GDE Monitoring and Mitigation Plan (Foreshore Native Vegetation)	Negligible

Loss of remnant vegetation of the foreshore reserve (risk EG77 and risk EG83)

Loss of vegetation could occur if groundwater drawdown below the Aspendale to Carrum Foreshore Reserve leads to an increase in seawater intrusion, activation of coastal acid sulfate soils or results in the water table dropping beyond the reach of plant roots.

Seawater intrusion

As described in Chapter 5 *Modelling the water environment,* changes to the salinity of groundwater can occur due to changes in the behaviour of the saltwater – freshwater interface as a result of onshore activities. An increase in groundwater salinity could affect vegetation if the salt content of the groundwater that the plants are accessing increases to a level that the plants cannot tolerate.

The project would potentially increase groundwater salinity, with groundwater quality generally remaining within the range that is suitable for potable use (refer to Technical Report A *Groundwater*). Chapter 5 *Modelling the water environment* provides data on the predicted change in salinity. Given that the foreshore vegetation is salt-tolerant, it is considered likely that the majority of the species that comprise the coastal dune vegetation will tolerate or adapt successfully to the potential increase in salinity.

Acid sulfate soils

Activation of coastal acid sulfate soils could occur through exposure of areas of potential coastal acid sulfate soils to oxygen. Coastal acid sulfate soils contain higher concentrations of iron sulfides or the products of sulfide oxidisation, which are natural and not a concern when left undisturbed. When disturbed or exposed, the sulfides come into contact with oxygen, break down and generate sulfuric acid. This means that a decline in groundwater level in these sediments could have the potential to result in acidification of the soils which in turn can lead to acidification of groundwater. This could render the water and/or soil unsuitable for the persistence of native plants leading to a loss of native vegetation. Refer to Chapter 7 *Acid sulfate soils and contamination* for further information. Acidification of groundwater could affect vegetation if the acidity of the groundwater that the vegetation is using rises to a level that vegetation cannot tolerate.

Chapter 7 *Acid sulfate soils and contamination* identifies some small pockets of potentially acid sulfate soils at Bonbeach that could be activated as a result of the Bonbeach project. No areas of potential acid sulfate soils are expected to be activated at Edithvale.

Although the areas of potential acid sulfate soils likely to be affected by the Bonbeach project are relatively small, and any acidification could reduce or dissipate by the time it migrates to the foreshore vegetation, it is not possible to completely rule out acidification occurring at the foreshore vegetation.

Therefore, the EPRs for the projects include a monitoring and management approach that addresses this potential impact. The management approach is outlined below.

Access to groundwater

Lowering of the water table beyond the reach of plant roots could result in a decline in health or loss of native plants within the foreshore reserve. The likelihood of this occurring is dependent on a number of factors, which influence the capacity of the plants to tolerate and/or adapt to the change, the magnitude of the change, and the timing and duration of change.

The design of the level crossing removal project has sought to minimise changes to groundwater levels (EPR reference GW1 and GW2). The potential for impacts at Edithvale are negligible as a result of the implementation of the project and EPRs. The project would achieve the outcomes required by EPR_GW2 (that the projects do not result in a significant impact on GDEs) through the addition of an engineering solution, which would improve the throughflow of groundwater around the trench. See Chapter 5 *Modelling the water environment* for a discussion of the proposed engineering solution at Edithvale.

Therefore, the maximum groundwater change (year 5 in the model described in Chapter 5 *Modelling the water environment*) in relation to the foreshore reserve at Edithvale ranges from 0.1 metres to 0.2 metres of drawdown (groundwater level decrease) as shown in Figure 6.12, and covers an area of 1.5 hectares. There is no groundwater change (drawdown) predicted within the foreshore reserve at Edithvale during a dry year (year 12 in the model) as shown in Figure 6.13.

Figure 6.12 Groundwater change (drawdown) predicted at Edithvale (during a wet year – year 5)

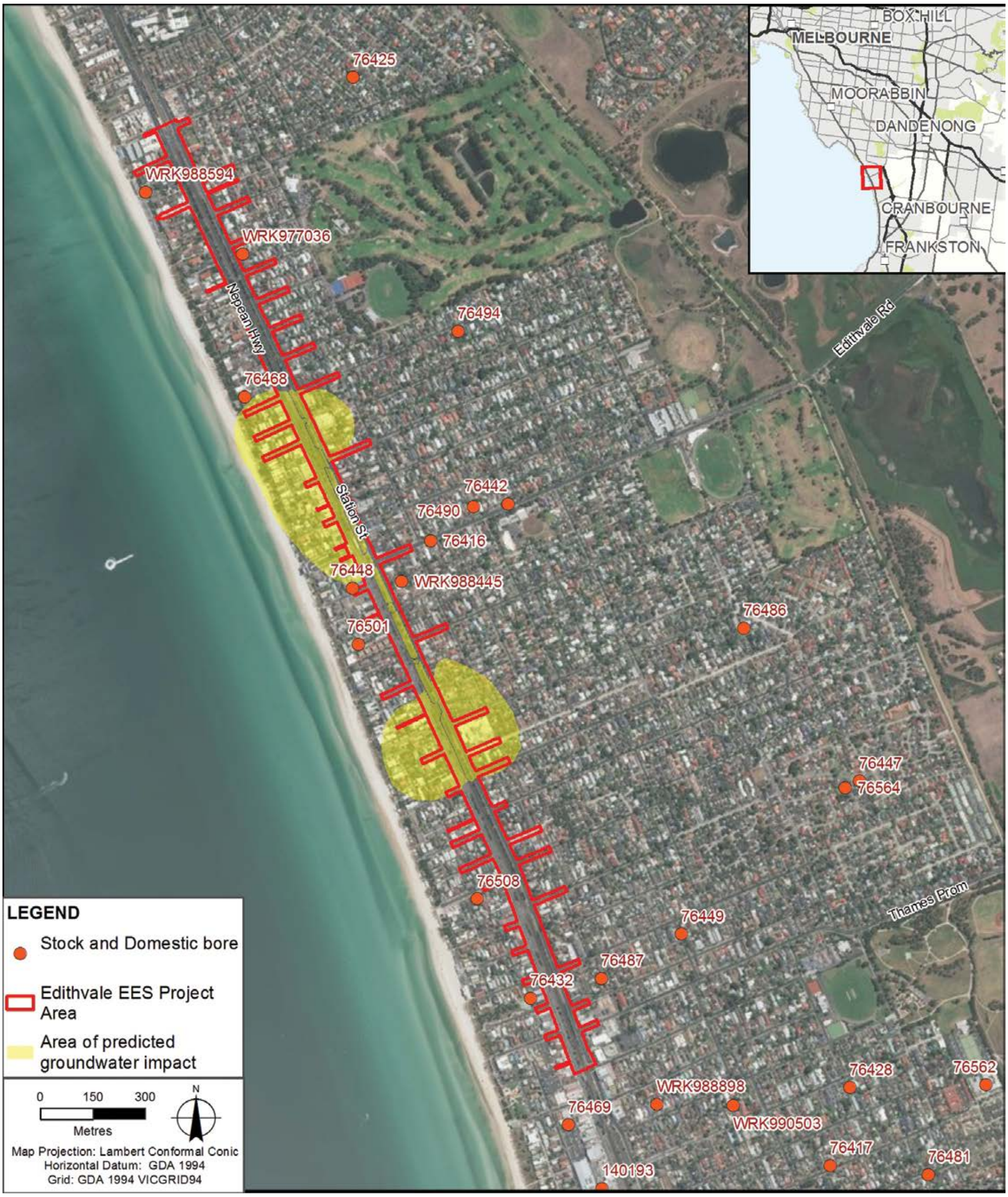
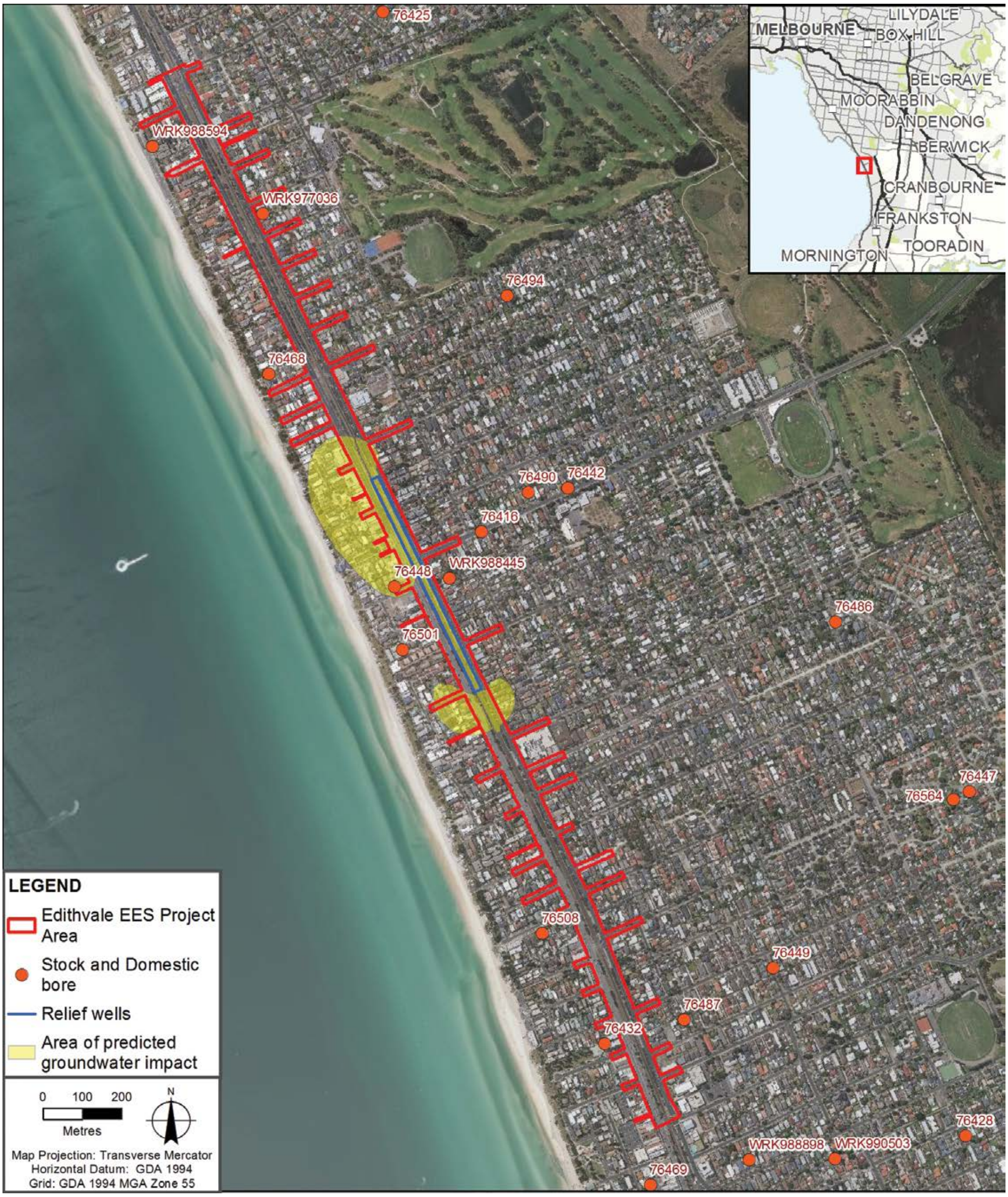


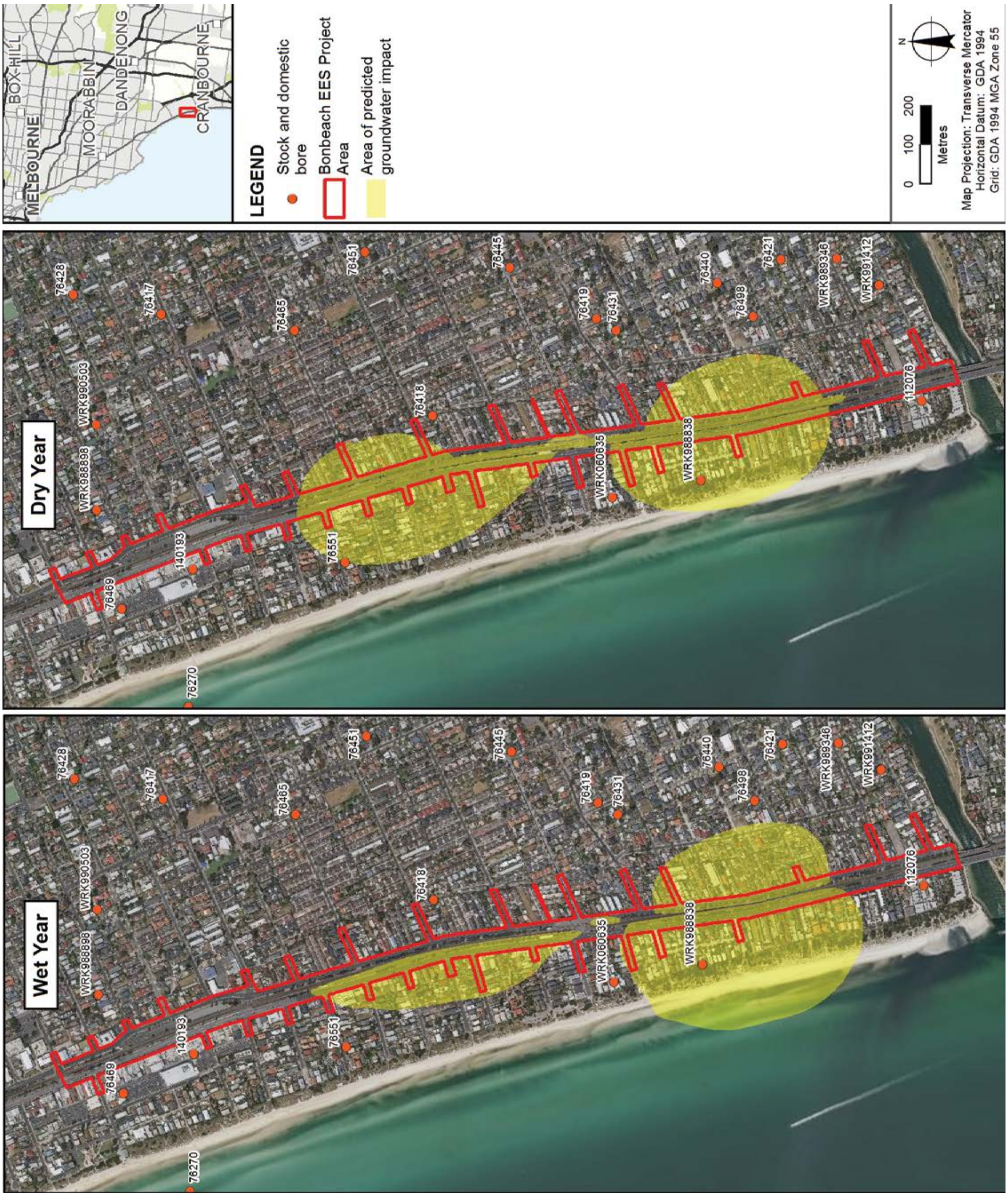
Figure 6.13 Groundwater change (drawdown) predicted at Edithvale (during a dry year – year 12)



The potential for impacts at Bonbeach are considered to be minor. The proximity of this site to the Patterson River means the direction of groundwater flow at the site of the level crossing removal is to the south west, as opposed to Edithvale which experiences a perpendicular groundwater flow path. This has the effect of reducing the volume of groundwater impeded by the pile walls, thus reducing the potential for groundwater drawdown at the Bonbeach site. At Bonbeach, an engineering solution is not required to achieve the performance outcomes (EPR reference GW2).

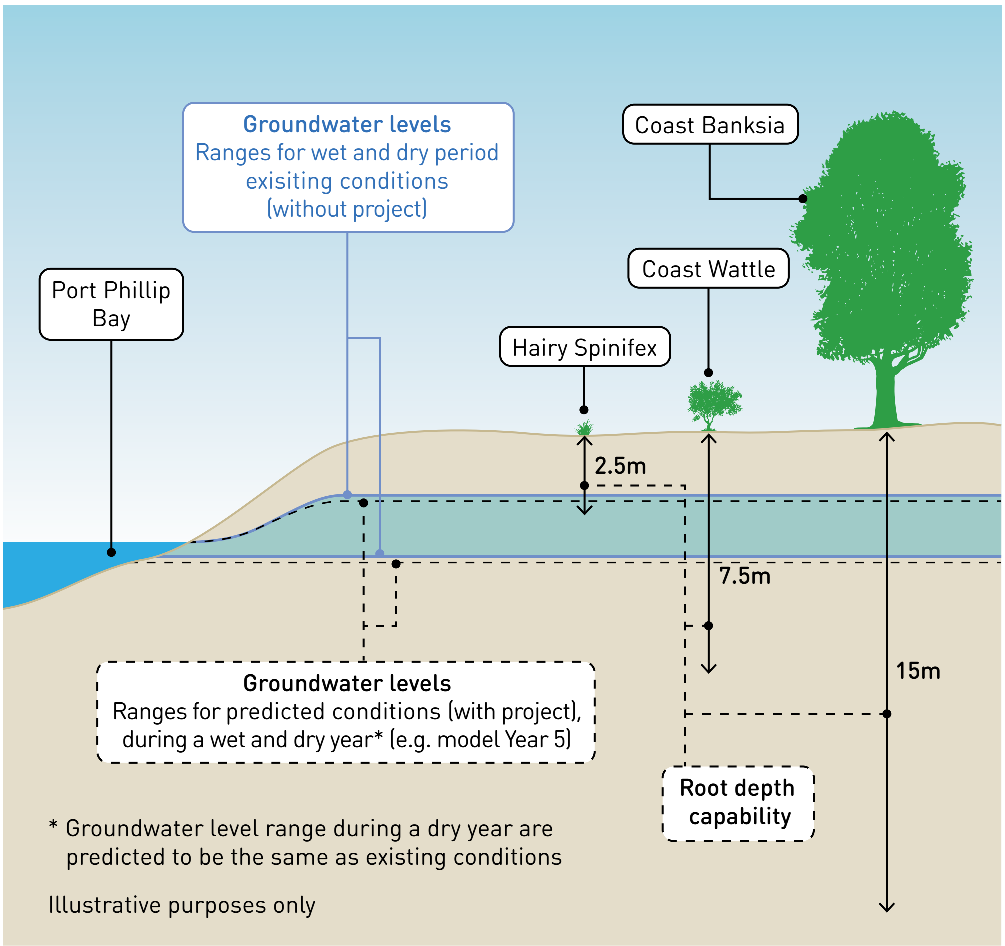
Therefore, the maximum groundwater change (year 5 in the model described in Chapter 5 *Modelling the water environment*) in relation to the foreshore reserve at Bonbeach arranges from 0.1 metres to 0.4 metres of drawdown (groundwater level decrease), as shown in Figure 6.14 (left hand side), and covers an area of 2.1 hectares. The predicted groundwater level change within the foreshore reserve at Bonbeach during a dry year ranges from 0.1 metres to 0.2 metres of drawdown (groundwater level decrease) as shown in Figure 6.14 (right hand side).

Figure 6.14 Groundwater change (drawdown) predicted at Bonbeach
Left – during a wet year (Year 5) Right – during a dry year (Year 12)



Any detrimental impact to the native vegetation of the foreshore reserve is likely to be dependent on the current reliance of the vegetation on groundwater as well as the likely duration and timing of project induced changes to groundwater that may eventuate. Groundwater data indicates that groundwater levels have fluctuated by up to two metres over the last 20 years, and during this period, plants within the foreshore reserve have persisted despite these existing natural variations. While the predicted changes in groundwater levels as a result of the level crossing removal project are within the range of natural variation (Figure 6.15), it is not possible to predict the cumulative impact of both the natural variation and the project-related drawdown on the coastal vegetation. However, the risk of impact has been assessed as minor at Bonbeach, and negligible at Edithvale, as the ability of the vegetation to tolerate the natural groundwater fluctuations demonstrates the inherent resilience of this vegetation.

Figure 6.15 Indicative root depth capability of foreshore coastal vegetation relative to predicted groundwater levels


Groundwater levels
Ranges for wet and dry period exisiting conditions (without project)
Coast Banksia
Port Phillip Bay
Coast Wattle
Hairy Spinifex
2.5m
7.5m
15m
Groundwater levels
Ranges for predicted conditions (with project), during a wet and dry year* (e.g. model Year 5)
Root depth capability
* Groundwater level range during a dry year are predicted to be the same as existing conditions
Illustrative purposes only

In addition, a literature review presented in the Technical Report B *Wetlands and Groundwater Dependent Ecosystems* refers to studies that have been undertaken in relation to sandy substrates and/or coastal environments which report that roots of plants in coastal environments can reach depths that exceed 10 metres and that roots have been recorded at depths of up to 15 metres and root to shoot ratios of 5:1 for plants less than 1.5 metres tall.

Groundwater levels within the coastal dune portion of the study area are likely to be highly dynamic, owing to the higher permeability of the Quaternary Aquifer along the coastal dune, and significant rainfall recharge response along the coastal dune (refer to Technical Report A *Groundwater*).

The dominant shrub species in the foreshore vegetation (Coast Tea-tree and Coast Wattle) were over one metre tall and the only tree species observed (Coast Banksia) grew up to 12 metres tall. Applying the 1:5 height to root ratio as detailed earlier, roots from these species could be reasonably expected to achieve depths of at least 5 metres below the base of the plant.

The existing groundwater depth under the foreshore reserve is predicted to range from 1.4 to 3.5 metres at Edithvale and from 1.6 to 3.3 metres at Bonbeach (refer to Technical Report A *Groundwater*). These ranges were based on predictions obtained from the numerical groundwater model, from the period 1997 to 2017.

Based on the ratio of plant height to root depth, some or all of the plant species within the coastal reserve may still be capable of accessing groundwater should the modelled drawdown be realised.

Management approach

Given the low risk to foreshore vegetation as a result of increased groundwater salinity, acidification of groundwater or reduced access to groundwater, the following management approach is proposed for the projects. A Groundwater Management and Monitoring Plan (EPR reference GW3) would be developed prior to commencement of construction.

The Groundwater Management and Monitoring Plan would include:

- detailed monitoring parameters including timing, location of monitoring bores
- duration of the monitoring program
- clear trigger levels for changes in groundwater level and quality that require mitigation plans to be implemented.

A Groundwater Dependent Ecosystem Monitoring and Mitigation Plan for the foreshore native vegetation would be developed in consultation with the land manager (EPR reference FF7). The mitigation plan would only be implemented if the trigger levels for changes to groundwater level and quality detailed in the Groundwater Management and Monitoring Plan were met.

The Groundwater Dependent Ecosystem Monitoring and Mitigation Plan would:

- identify areas of coastal vegetation potentially impacted by a change to groundwater quality and/or levels as a result of the projects
- include a process to monitor groundwater to confirm any changes to groundwater quality and/or levels that could result in a loss of coastal native vegetation
- include a process for monitoring coastal native vegetation developed by a suitably qualified ecologist
- include criteria for determining whether a change in the extent or condition of coastal native vegetation is attributable to the projects
- include contingency measures to mitigate potential impacts attributable to the projects
- include the frequency and duration of monitoring.

The monitoring program would inform whether changes in the condition and/or extent of vegetation were occurring and what, if any, contingency measures should be implemented to mitigate impacts.

Habitat fragmentation (risk EG78 and risk EG84)

Any loss of vegetation within the foreshore reserve as a result of groundwater drawdown would disrupt the narrow corridor of habitat which extends along the foreshore reserve. This would result in the exacerbation of a threatening process – habitat fragmentation – which is listed under the FFG Act. However, fragmentation is rated as a negligible risk at both Edithvale and Bonbeach, on the basis of the narrow nature of the corridor and the landscape context of the corridor in an urbanised, modified environment.

The Groundwater Dependent Ecosystem Monitoring and Mitigation Plan outlined above (EPR reference FF7) would inform whether changes in the condition and/or extent of vegetation were occurring and what, if any, contingency measures should be implemented to mitigate impacts.

6.7 Other GDEs within the study area

6.7.1 Existing conditions

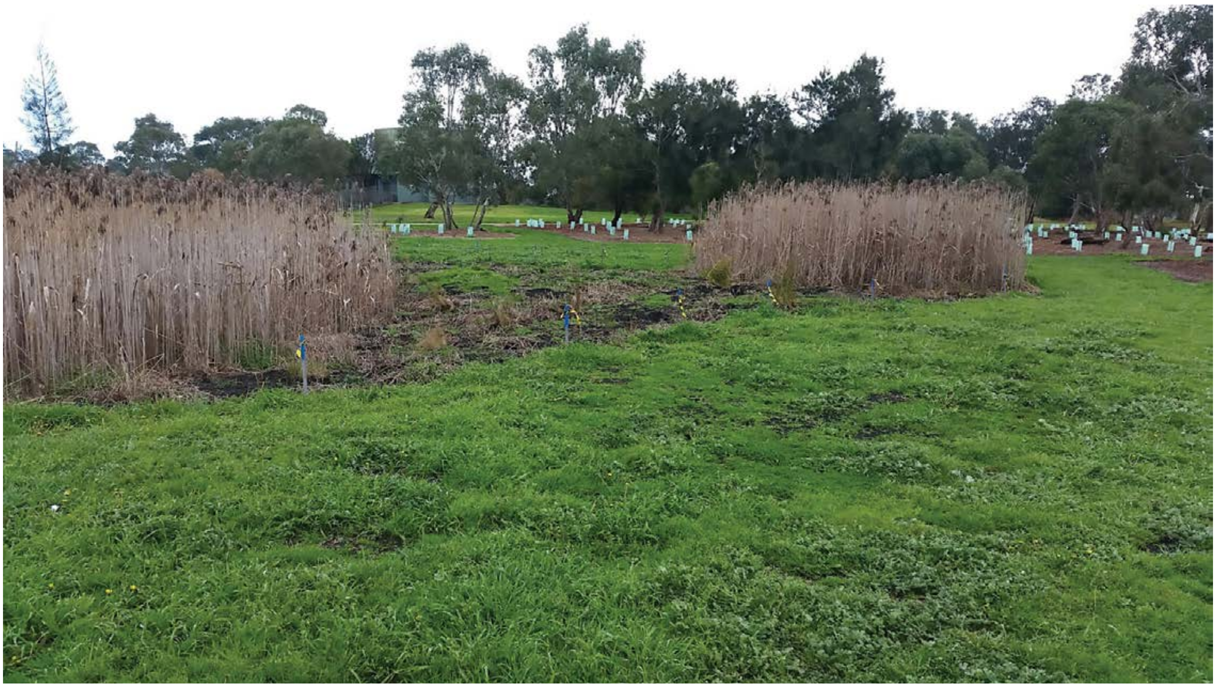
Other GDEs modelled to occur within the study area include:

- **Edithvale Common** – a recreation reserve adjacent to Edithvale Wetland, which includes Memorial Oval, walking tracks and open space with areas of revegetation (refer Figure 6.16).
- **Patterson River** – an artificial waterway with the southern bank primarily consisting of rocks or concrete retaining walls and the northern bank consisting of rocks in proximity to the Nepean Highway, and patches of native vegetation further upstream where the bank becomes less artificial in appearance.
- **Centre Main Drain** – a large, man-made linear drainage channel commencing at Mordialloc Creek and terminating at an outfall on the Patterson River and comprising an open swale/retention basin along with a pipe underground. The invert elevation of Centre Main Drain is lower than shallow groundwater, indicating that Centre Main Drain likely receives seasonal groundwater discharges.
- **Golf courses (Rossdale Golf Club, Chelsea Golf Club and Patterson River Golf Club)** – typically characterised by mown grass fairways, manicured greens, waterbodies, sand bunkers and areas of planted trees and shrubs.
- **Chelsea Bicentennial Park** – a large recreation reserve adjacent to Wannarkladdin Wetlands dominated by large expanses of manicured, exotic grassland and some planted native trees. The reserve also incorporates Beazley Reserve (sporting oval) and the Chelsea Heights Community Centre.
- **Residential areas** – including residential streets and back yards. Residential streets typically contain semi-mature and mature planted native trees above manicured lawn nature strips. Vegetation within residential lots is far more variable with some lots containing large ornamental gardens while others are dominated by hardstand areas.

Other GDEs identified within the study area are not particularly significant individually, although their collective contribution may be valuable at a landscape scale. For instance, Bicentennial Park and Centre Main Drain form a network of habitats and/or open space linking Wannarkladdin Wetland and Edithvale Wetland.

A number of the residential lots within the study area are covered by Schedule 3 to the Environmental Significance Overlay under the Kingston Planning Scheme, which identifies significant exotic, native and indigenous trees.

Figure 6.16 Edithvale Common



Vegetation and habitat

There were no patches of native vegetation observed within these 'other GDEs' where access was available. Any native vegetation that may occur in inaccessible areas such as golf courses and private residences is likely to be limited in extent and quality given its urban setting.

The study area beyond Edithvale Wetland and Wannarkladdin Wetlands is characterised by a mix of recreation reserves, streets with planted trees above manicured lawn nature strips, and residential lots with ornamental gardens and hardstand areas. While individually of limited habitat value, the sum of these GDEs may be valuable at a landscape scale. Collectively, the canopy provided by trees throughout the residential areas (in gardens and along nature strips) represents an extensive area of foraging and resting habitat particularly for birds and possums.

Threatened and/or migratory animals

Edithvale Common, Patterson River, some of the local golf courses and Chelsea Bicentennial Park all contain a small number of records of threatened animal species. Their use as habitat by such species is likely to be due to their proximity to Edithvale Wetland and Wannarkladdin Wetlands, rather than the habitat they provide individually and in isolation of the wetland complex.

Threatened plants

No threatened plants are considered likely to occur within these areas.

6.7.2 Impact assessment

Construction

No risks were identified for the construction phase of the Edithvale and Bonbeach level crossing removals in relation to the other GDEs within the study area. Refer to Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems.*

Operation

The initial and residual risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects in relation to the other GDEs within the study area are outlined in Table 6.5.

Table 6.5 Other GDEs within the study area risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
EG79	Other vegetation / fauna habitat (Edithvale)	Groundwater change leading to altered hydrological regime and/or changes in water quality resulting in the loss of undocumented remnant vegetation and/or planted vegetation and habitat outside of high value GDEs (i.e on residential properties) to the east (inland) of the rail corridor.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes	Negligible
EG85	Other vegetation / fauna habitat (Bonbeach)	Groundwater change leading to altered hydrological regime and/or changes in water quality resulting in the loss of undocumented remnant vegetation and/or planted vegetation and habitat outside of high value GDEs (i.e on residential properties) to the east (inland) of the rail corridor.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater performance outcomes	Negligible

Groundwater mounding (risk EG79)

Groundwater mounding could result in the loss of vegetation and habitat in the residential areas east of the rail corridor through saturation of the root zones. The risk of this occurring is greatest in proximity to the project areas as this is where groundwater mounding (increase in groundwater level) is predicted to be most pronounced.

No remnant vegetation was identified in the area modelled to be affected by groundwater mounding, however it is possible that remnant trees such as large old Coast Banksia and eucalypts are on some residential lots scattered throughout the suburbs. Collectively the canopy provided by trees throughout the residential areas (in gardens and along nature strips) represents an extensive area of foraging and resting habitat particularly for birds and possums.

Impacts on an ecological level are not predicted to occur. The level crossing removal projects have been designed to minimise changes to groundwater levels (EPR reference GW1 and GW2) and therefore the projects would result in a negligible risk to other GDEs in the study area. No further mitigation is required.

Groundwater drawdown (risk EG85)

Groundwater drawdown (decrease in groundwater level) could result in the loss of vegetation in residential areas between the foreshore reserve and rail corridor through a lowering of the water table beyond the reach of roots, an increase in saline intrusion and/or activation of coastal acid sulfate soils. The risk of this occurring is greatest in close proximity to the project areas as this is where groundwater drawdown is predicted to be most pronounced.

No remnant vegetation is identified in the area of predicted drawdown, however it is possible that a small number of remnant trees such as large old Coast Banksia (Figure 6.8) and eucalypts exist on some residential lots. Collectively the canopy provided by trees throughout the residential areas (in gardens and along nature strips) represents foraging and resting habitat for local non-threatened fauna species, particularly birds and possums.

Like the foreshore reserve, the degree of vegetation dependence on groundwater and the potential extent and likelihood of impacts are difficult to determine. However, the risk of losing scattered trees and fauna habitat in this area is considered to be negligible given the highly urbanised environment within the area of potential groundwater drawdown.

The unavoidable loss of other vegetation and habitat that may occur as a result of groundwater drawdown is considered to constitute a negligible risk, given the context of the projects in a modified, urban environment. No further mitigation is required.

6.8 Conclusion

A number of potential GDEs were identified to occur within the Edithvale and Bonbeach level crossing removals study area.

These included two high value GDEs:

- **Edithvale Wetland section of the Edithvale-Seaford Wetlands Ramsar site** – The wetland supports remnant vegetation and a diversity of habitat for a range of plant and animals. It provides potential habitat for significant plant species and is known to support a high diversity of significant birds including shorebirds listed under international agreements for migratory birds and wetland-dependent birds listed under the EPBC Act.
- **Wannarkladdin Wetlands** – These wetlands are ecologically similar to Edithvale Wetland, although not of national significance. The Wannarkladdin Wetlands provide habitat for a number of waterbirds and shorebirds and are part of a nationally significant complex of wetlands (which includes the Edithvale-Seaford Wetlands).

Regional numerical groundwater modelling presented in Technical Report A *Groundwater* indicated that groundwater mounding was not predicted to extend to the Edithvale Wetland (refer to Chapter 5 *Modelling the water environment*). As discussed in Appendix III *Matters of National Environmental Significance (Edithvale-Seaford Wetlands),* impacts on the habitat of Edithvale Wetland are therefore not expected as a result of the level crossing removal projects. As such, the capacity of the site to meet the Ramsar listing criteria would not be compromised by the level crossing removal projects.

Similarly, no impacts are expected at Wannarkladdin Wetlands and no changes to wetland function or character are anticipated as a result of the level crossing removal at Bonbeach. Despite this, a Groundwater Management and Monitoring Plan would be developed to monitor and manage predicted and potential impacts to groundwater following construction of the pile walls. A Groundwater Dependent Ecosystem Monitoring and Mitigation Plan for Edithvale Wetland would be developed in consultation with the land manager and the Commonwealth Department of the Environment and Energy. The mitigation plan would only be implemented in the unlikely event that trigger levels for changes to groundwater level and quality detailed in the Groundwater Management and Monitoring Plan were realised.

The Aspendale to Carrum Foreshore Reserve is identified by the Kingston City Council as a key natural resource area. The reserve contains remnant indigenous vegetation, which supports a diverse range of plants and comprises a corridor of vegetation that is likely to facilitate the movement of fauna through the local area. The groundwater modelling predicted that groundwater drawdown could occur under the Aspendale to Carrum Foreshore Reserve. This could result in an increase in seawater intrusion, potential acidification of groundwater accessed by the foreshore vegetation and a lowering of the water table beyond the reach of plant roots.

The design of the level crossing removal project has sought to minimise changes to groundwater levels (EPR reference GW1 and GW2). There is a minor residual risk that groundwater drawdown could affect vegetation within the Aspendale to Carrum Foreshore Reserve at Bonbeach. The potential for impacts on the foreshore vegetation at Edithvale are considered to be negligible due to the smaller area likely to be affected, the lower magnitude of drawdown and the engineering solution that has been considered. A management approach is proposed in the EPRs for the projects to mitigate potential impact on vegetation within the Aspendale to Carrum Foreshore Reserve and ensure impacts are not significant.

Other GDEs identified within the study area are not ecologically significant individually, although their collective contribution may be valuable at a landscape scale. Groundwater mounding could result in the loss of vegetation and habitat east of the rail corridor through saturation of the root zones. Groundwater drawdown could also result in the loss of vegetation and habitat west of the rail corridor through a lowering of the water table beyond the reach of roots, which could result in increased risk of seawater intrusion and/or activation of coastal acid sulfate soils. However, the loss of other vegetation and habitat in the study area that may occur as a result of groundwater mounding or drawdown is considered to represent a negligible risk given the context of the projects in a modified, urban environment.

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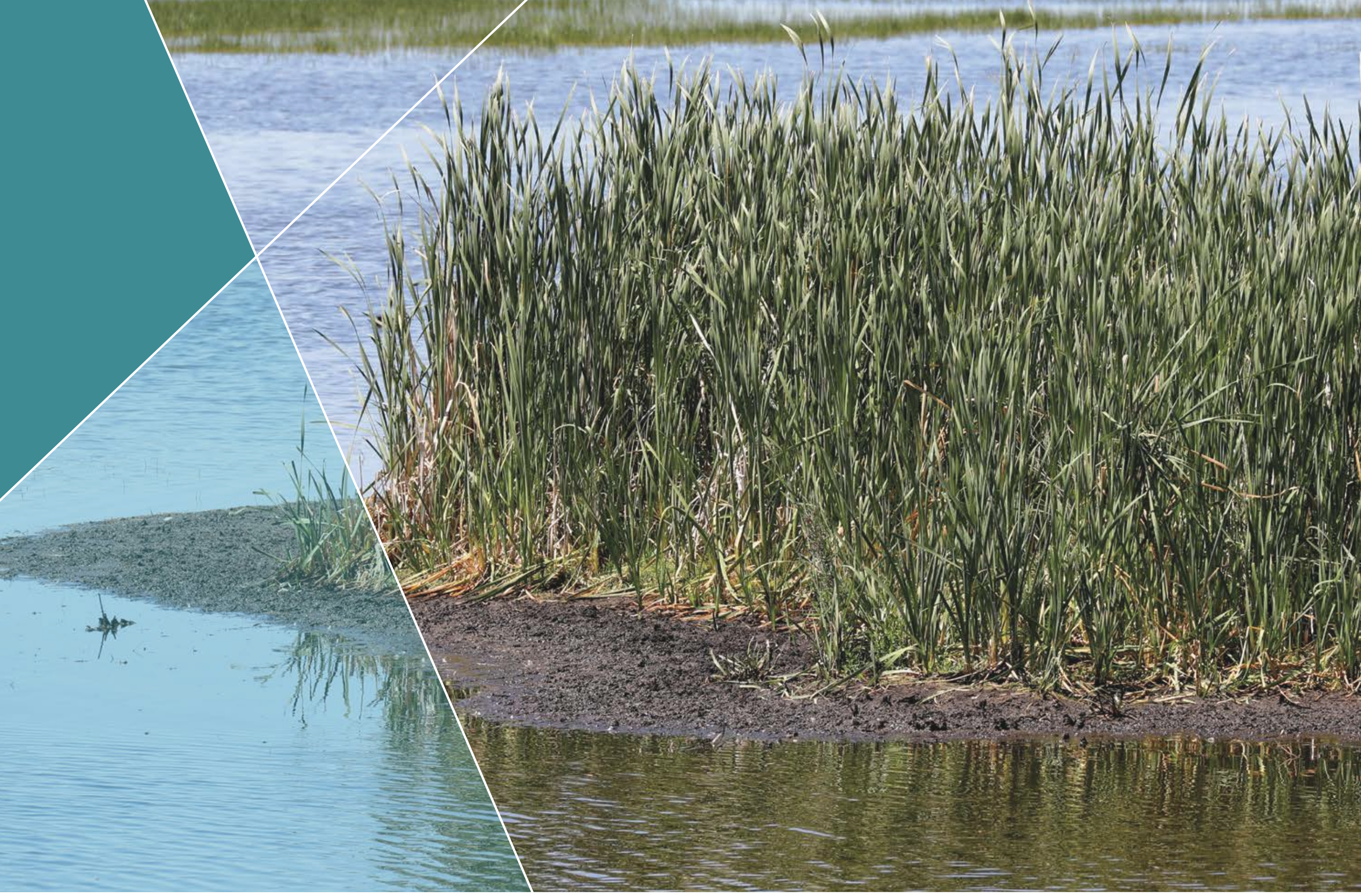

7 ACID SULFATE SOILS AND CONTAMINATION

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7.2	**What is contamination?**	**7.3**
7.3	**Methodology**	**7.4**
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During construction, excavated material (spoil) has the potential to contain contaminated material or acid sulfate soils. Contaminated soil and groundwater, and acid sulfate soils, have the potential to impact human health and the environment, particularly for nearby residents and land uses. This chapter summarises the potential impacts of contaminated soil and groundwater, and acid sulfate soils, which would be disturbed by the projects.

The Scoping Requirements for the EES include the following evaluation objective:

- **Contaminated/acid sulfate soils** – to prevent adverse environmental or health effects from disturbing, storing or influencing the transport or movement of contaminated or acid-forming material.

To assess the potential effects of contaminated and/or acid sulfate soils on human health and the environment as a result of the projects, an acid sulfate soil, contamination and spoil impact assessment was undertaken. The assessment included a detailed acid sulfate soil investigation and an indicative soil and groundwater contamination investigation to gain a general understanding of the soil and groundwater conditions of the project areas. The findings of the assessment are presented below, with a detailed report included in EES Technical Report C *Acid sulfate soils and contamination*.

A summary of the key findings from this chapter is presented in Table 7.1.

Table 7.1 Summary of key findings

Topic	Key finding
Acid sulfate soils and contamination	The projects would prevent adverse environmental or health effects from disturbing, storing or influencing the movement of contaminated or acid-forming material, and be designed to protect beneficial uses. Excavation of material that is likely to be contaminated would be unavoidable, however implementation of well-defined and established practices to manage environmental and human health risks would be implemented.

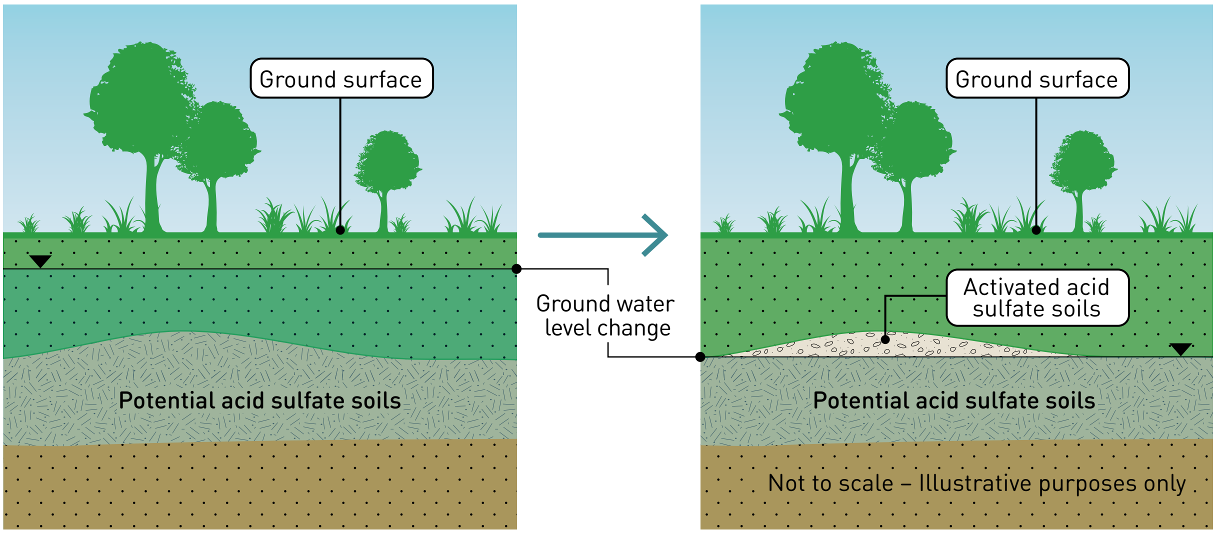
7.1 What are acid sulfate soils?

Acid sulfate soil is the common name given to soils containing minerals like iron sulfides – predominately pyrite, which can occur naturally mostly near water bodies. Where acid sulfate soils occur in coastal settings they are commonly referred to as coastal acid sulfate soil. Since the projects are located within a coastal setting, the acid sulfate soils are referred to as coastal acid sulfate soils in this chapter.

Acid sulfate soils which have not been exposed to air, such as when contained in a layer of waterlogged soil, are known as potential acid sulfate soils (refer to Figure 7.1 below). When these soils are exposed to air (in a process called oxidation) either naturally (for example, during a drought), through soil disturbance (for example, during excavation) or through a lowered water table (for example, in drain construction), the iron sulfides can react with oxygen and water to produce sulfuric acid. The soils which become acidic due to this process are called actual acid sulfate soils.

The oxidation of coastal acid sulfate soils can result in the generation, mobilisation and migration of acidity which can liberate contaminants (for example nutrients and metals) and potentially impact the environment, in-ground structures and human health.

Figure 7.1 Conceptual illustration of acid sulfate soil activation through lowering of groundwater


Ground surface
Potential acid sulfate soils
Ground water
level change
Ground surface
Activated acid
sulfate soils
Potential acid sulfate soils
Not to scale – Illustrative purposes only

7.2 What is contamination?

Contamination of land and groundwater is primarily the result of human activity which results in the release of harmful substances, such as industrial chemicals, either directly or indirectly, into the existing environment. Contamination can be caused by both historic and current practices, such as poor storage, handling and disposal of substances.

Typical uses that can or have resulted in contamination of land and groundwater include spills or leaks from service stations, industrial or manufacturing facilities, illegal dumping and uncontrolled filling of a site (for example material brought in for historic maintenance activities that was not properly tested). Contamination can have a harmful impact on the environment and human health through direct contact with contaminated soil, vapours from the contaminants and from secondary contamination of groundwater and surface water. Many practices from the past, which would be considered unacceptable today, have resulted in long-term contamination of land and groundwater.

The project areas are largely within an infrastructure corridor that is bounded by road reserves and residential areas, however, there are areas of commercial or industrial uses that may give rise to contamination. Because contamination can migrate through the soil profile and within the flow of groundwater, it is important to also consider potential contamination sources that are outside of the project areas.

7.3 Methodology

The method of the impact assessment included:

- identification of historical activities at the project areas that may have caused contamination to soil and groundwater likely to be encountered during construction
- assessment of the potential for acid sulfate soils to be encountered during construction
- assessment of the spoil management options to appropriately manage spoil produced during construction
- assessment of impacts that would occur after construction, as a result of changes in groundwater levels.

7.3.1 Acid sulfate soils

The process for identifying and assessing coastal acid sulfate soils is outlined in the EPA Victoria's Industrial *Waste Management Policy* 2009 and *Victorian best practice guidelines for assessing and managing coastal acid sulfate soil* 2010. These guidelines were used as the basis for developing the methodology used to determine the potential of the projects to interact with coastal acid sulfate soils for the assessment presented in this EES and would be applied during construction so that any coastal acid sulfate soils generated by the projects is managed in accordance with best practice.

The guidelines outline a four-stage process (Stages A to D), which is further detailed below. The guidelines set out when there is a need to manage the soils as coastal acid sulfate soil, with consideration to soil texture and quantity.

Stage A: Preliminary coastal acid sulfate soils hazard assessment

A desktop review was undertaken of available coastal acid sulfate soils maps and previous investigation reports. A site inspection of the project areas was also undertaken to identify any obvious field indicators of coastal acid sulfate soils, such as:

- iron staining
- corroded steel or concrete structures
- swamp tolerant, salt tolerant or marine vegetation.

Stage B: Detailed site soil sampling program and assessment

A soil investigation program was conducted, which included the drilling of 41 bores across both project areas for collection of soil samples at 0.5-metre intervals, to a maximum of 22.5 metres below ground surface.

A total of 1,045 soil samples were collected in accordance with relevant guidelines and analysed by National Association of Testing Authorities (NATA) accredited laboratories. All the soil samples were analysed for indicative field testing of coastal acid sulfate soils and based on the results of these tests, 292 samples were selected for detailed laboratory testing of acidity/neutralising capacity to verify the existence and nature of acid sulfate soils.

Stage C: Surface/groundwater sampling program and assessment

Surface water sampling was not undertaken as permanent surface water features were not identified at either of the project areas. A groundwater assessment for coastal acid sulfate soils and contamination was undertaken as part of the broader hydrogeological assessment for both Edithvale and Bonbeach (refer to EES Technical Report A *Groundwater*).

The groundwater assessment in relation to the coastal acid sulfate soils assessment included measuring groundwater levels and groundwater sampling. A total of 23 primary groundwater samples were collected, with 11 from Edithvale and 12 from Bonbeach. Samples were analysed by a NATA accredited laboratory for pH, salinity, ions, acidity, alkalinity, heavy metals and nutrients.

Stage D: Coastal acid sulfate soils hazard assessment

The purpose of the Stage D assessment is to determine the level of hazard (low, medium or high) associated with the coastal acid sulfate soil disturbance and to use the hazard rating to determine the planning and management strategies that would be implemented to prevent adverse impacts from disturbing coastal acid sulfate soils. The guidelines require that the results of the Stage B assessments are used to determine the hazard level associated with disturbing acid sulfate soils as a result of the projects. Refer to Section 7.4.1 for the results of the Stage D assessment.

7.3.2 Contamination

To assess the existing contaminated land conditions and identify potential sources of contamination within or near the project areas, a desktop review was undertaken (generally within a 500 metre radius of the project area). This included a review of historical aerial photographs and plans, publicly available literature, and geological, hydrogeological and topographical conditions. A site inspection was also undertaken to document and confirm site features and inspect potential sources of contamination.

Indicative soil and groundwater samples were obtained as part of the intrusive investigation undertaken for the coastal acid sulfate soils assessment. A total of 89 primary soil samples were collected and analysed from 41 locations (42 samples at Edithvale and 47 samples at Bonbeach). A total of 23 primary groundwater samples were collected, with 11 from Edithvale and 12 from Bonbeach. Samples were analysed for various contaminants such as heavy metals and hydrocarbons and select samples were submitted for analysis of per-and polyfluorinated alkyl substances (PFAS, a relatively new emerging contaminant) based on findings from the desktop assessment. Further details on the location and extent of the intrusive sampling investigation are in Section 4.2.2 of EES Technical Report C *Acid sulfate soils and contamination*.

The sampling and analysis program was undertaken adjacent to the proposed rail trench to minimise disruption to rail operations and protect the safety of personnel undertaking the field investigation. The results of the investigation are considered to be indicative of the contamination status of the soils and groundwater to be encountered during the excavation and provide a reasonable estimate for the volumes and nature of contaminated material that may be excavated and require management. Further testing would be undertaken during the detailed design phase and prior to major excavation in accordance with Australian Standard 4482.1 *Guide to the investigation and sampling of site*s *with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds*, and be managed in accordance with *Environment Protection (Industrial Waste Resource) Regulations* 2009 and the *Occupational Health and Safety Regulations* 2007. This is also included in the *Environmental Performance Requirements* (EPR references CL1 and CL2) in order to confirm the volumes and nature of contamination to be managed.

7.4 Existing conditions

7.4.1 Acid sulfate soils

Coastal acid sulfate soil hazard mapping indicates that the project areas falls within land mapped as 'prospective' for coastal acid sulfate soils (based on Victorian State Government mapping data published in 2003), and have a 'high probability/high confidence' for the occurrence of coastal acid sulfate soils (Australian Soil Resource Information System (ASRIS) – CSIRO, 2012). However, field indicators for coastal acid sulfate soils were not observed during the site inspection.

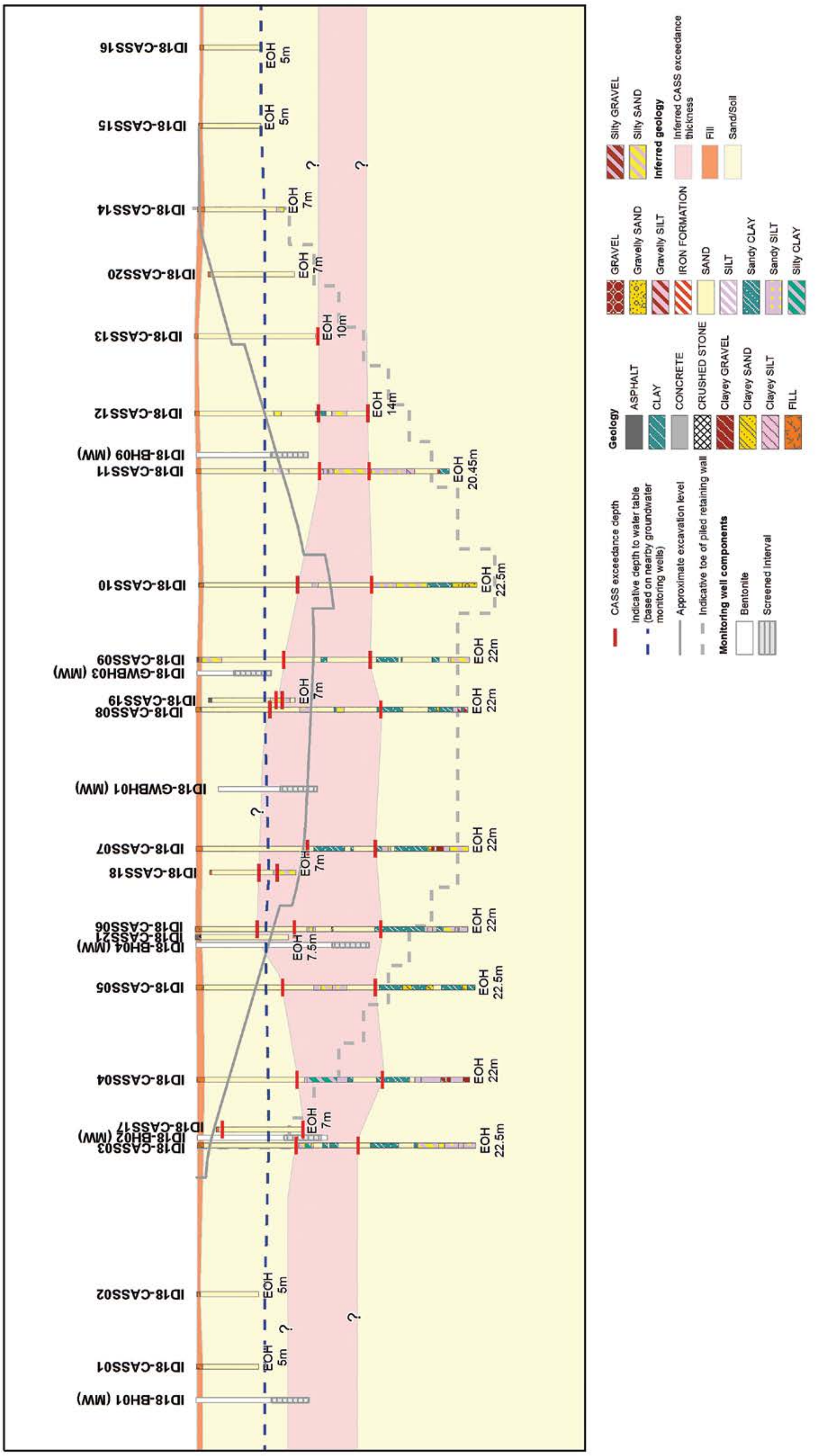
The field pH measurements in soils showed that approximately 45 per cent of samples at Edithvale and 31 per cent of samples at Bonbeach indicated the presence of actual acid sulfate soils or potential acid sulfate soils. The detailed laboratory results indicated that the majority of the samples selected for further analyses (71 per cent at Edithvale and 73 per cent at Bonbeach) were potential acid sulfate soils and could produce acidity when disturbed. The presence of actual acid sulfate soils was noted in 10 sandy to silty clay samples, between five and 10 metres below ground surface at Edithvale. At Bonbeach actual acid sulfate soil was present in four samples, in the fill sand (0.1 to one metre below ground surface) and the deeper sandy to silty clay layer (15 to 16 metres below ground surface). Approximately one third of the Edithvale samples and 39 per cent of the Bonbeach samples recorded net acidity exceeding the criteria given in *Victorian best practice guidelines for assessing and managing coastal acid sulfate soil* 2010. Based on the analytical results and observations, the likelihood of encountering any coastal acid sulfate soils at deeper layers ranging between 22 to 23 metres below ground is considered low.

The groundwater assessment in relation to acid sulfate soils indicated the presence of existing acidity at both Edithvale and Bonbeach in the shallow aquifer, however, the groundwater has sufficient ability to neutralise any acidity currently being produced. Groundwater levels and water quality are discussed in detail in Chapter 5 *Modelling the water environment*.

The Stage D hazard assessment indicates that the hazard associated with the disturbance of coastal acid sulfate soils at the project areas is considered 'High'. In accordance with the guidelines, it is recommended that where possible, disturbance of coastal acid sulfate soils be avoided. Where this is not possible (for example, when installing the piles and excavating the trench), an Acid Sulfate Soils Management Plan must be developed and include a description of how the proposed works would disturb coastal acid sulfate soils and appropriate management strategies to minimise impacts. The results of the assessment provide confidence on the location of coastal acid sulfate soils in the project areas and a sound and robust Acid Sulfate Soils Management Plan can be developed based on the results for both projects (EPR reference CL2).

Figure 7.2 and Figure 7.3 illustrate the findings of the coastal acid sulfate soils investigation, indicating potential acid sulfate soils are present at both Edithvale and Bonbeach, ranging from approximately 4 metres to 15 metres below the ground surface in the Edithvale project area and 3.5 metres to 16 metres below the ground surface in the Bonbeach project area.

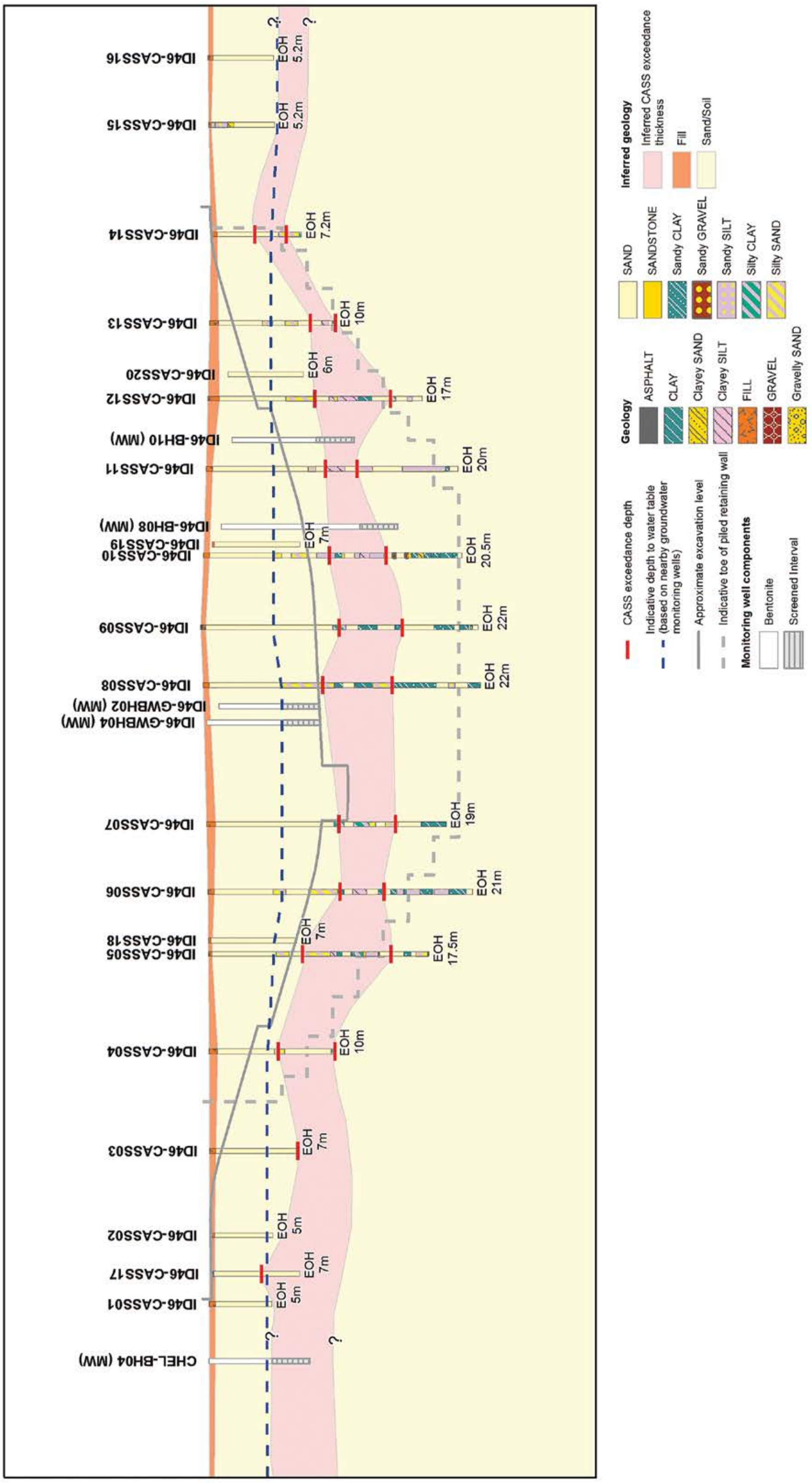
Figure 7.2 Potential waste acid sulfate soils (Edithvale)



Graphics showing inferred fill/CASS exceedance/sand/soil are indicative only

A larger format version of this figure is provided in Attachment VI Map book.

Figure 7.3 Potential waste acid sulfate soils (Bonbeach)



Graphics showing inferred fill/CASS exceedance/sand/soil are indicative only

A larger format version of this figure is provided in Attachment VI Map book.

7.4.2 Contamination

Site contamination is reasonably common in Victoria as a legacy of past industrial use and poor waste management practices that would be unacceptable today. Like a lot of areas with a similar history of industrial and manufacturing uses, combined with poor waste management and environmental practices, there are potentially contaminated sites present along and adjacent to the project areas.

The Edithvale and Bonbeach project areas are located within a modified urban environment. The project areas are underlain by Quaternary age aeolian and swamp deposits, which in turn overlie the Pliocene age Baxter Sandstone or Brighton Group sediments. A variable thickness of anthropogenic fill material overlies the natural geological materials associated with the construction of the local transport and residential/commercial infrastructure.

The desktop review of potential sources of contamination found that there were no priority sites or EPA Victoria licences within the project areas or within a 500 metre radius of the project area. There were no active environmental audits listed within either project area; although six environmental audits had been completed for sites within a 500 metre radius of the Edithvale project area, and two Statements of Environmental Audits had been conducted within a 500 metre radius of the Bonbeach project area. The audit findings from the sites indicated the presence of soils and/or groundwater contaminated with heavy metals, petroleum hydrocarbons and/or nutrients.

The following table outlines the potential sources of contamination identified in the desktop assessment and site inspection also shown in Figure 7.4 and Figure 7.5. While these site uses do not necessarily mean soil and/or groundwater contamination has occurred in the past, they are generally an indicator of potential sources of contamination. Identification of these types of site uses provides guidance on what type of contamination may be present, which is used to develop contaminant appropriate sampling and analysis programs to identify and characterise the contamination present. This information would be used to manage the construction of the projects and any existing contamination affected by the projects.

Table 7.2 illustrates the potential sources of contamination identified in the desktop assessment within, and adjacent to, the project areas.

Table 7.2 Potential sources of contamination

Location	Potential source of contamination
Edithvale	
Within project area	Anthropogenic fill material in the rail corridor
	Quaternary Sands – naturally occurring disseminated pyrite
Outside project area	• Existing and former service stations on Nepean Highway and Station Street • Former dry cleaners on Nepean Highway • Commercial/industrial areas on the Nepean Highway • Boat storage on the Nepean Highway • Former car dealer on Nepean Highway • Upholsterer on Nepean Highway • Mechanics on the Nepean Highway • Mower sales/service centre on the Nepean Highway • Three sites issued with Victorian EPA statements of audit (audit numbers 70603-1, 36865-1, 54038-1) due to the presence of soil and/or groundwater contamination
Bonbeach	
Within project area	Anthropogenic fill material in the rail corridor, electrical sub-station
	Quaternary Sands – naturally occurring disseminated pyrite
Outside project area	• Panel beaters on Station Street • Substation on the Nepean Highway • Furniture manufacturer on the Nepean Highway • Mower sales/service centre on the Nepean Highway • Commercial/industrial areas along the Nepean Highway • Existing and former service stations on the Nepean Highway and Station Street • Laundromat on the Nepean Highway • Two sites issued with Victorian EPA statements of audit (audit numbers 36865-1, 51704-1) due to the presence of soil and/or groundwater contamination

Figure 7.4 Part A: Potential contamination sources (Edithvale)

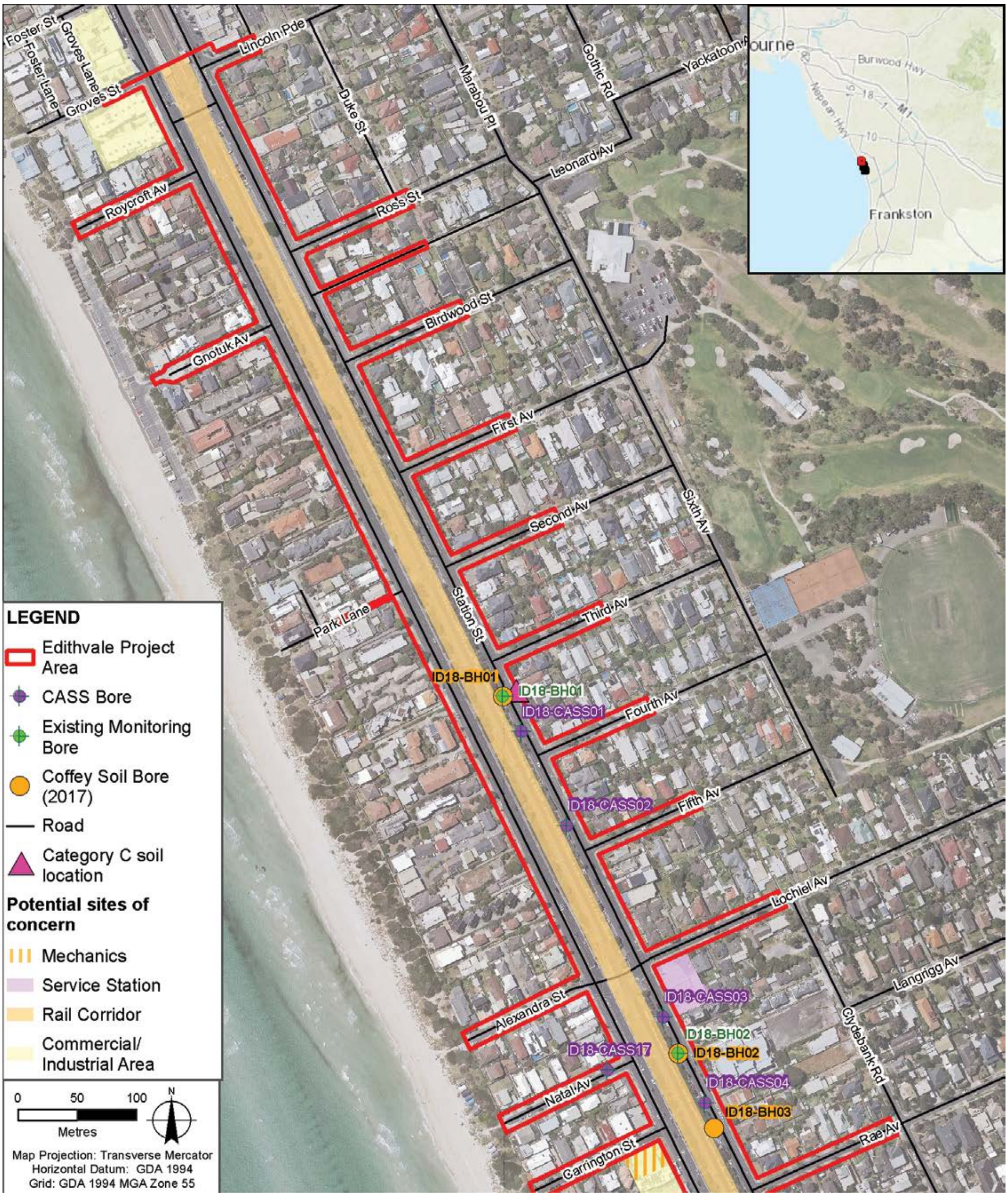


Figure 7.4 Part B: Potential contamination sources (Edithvale)

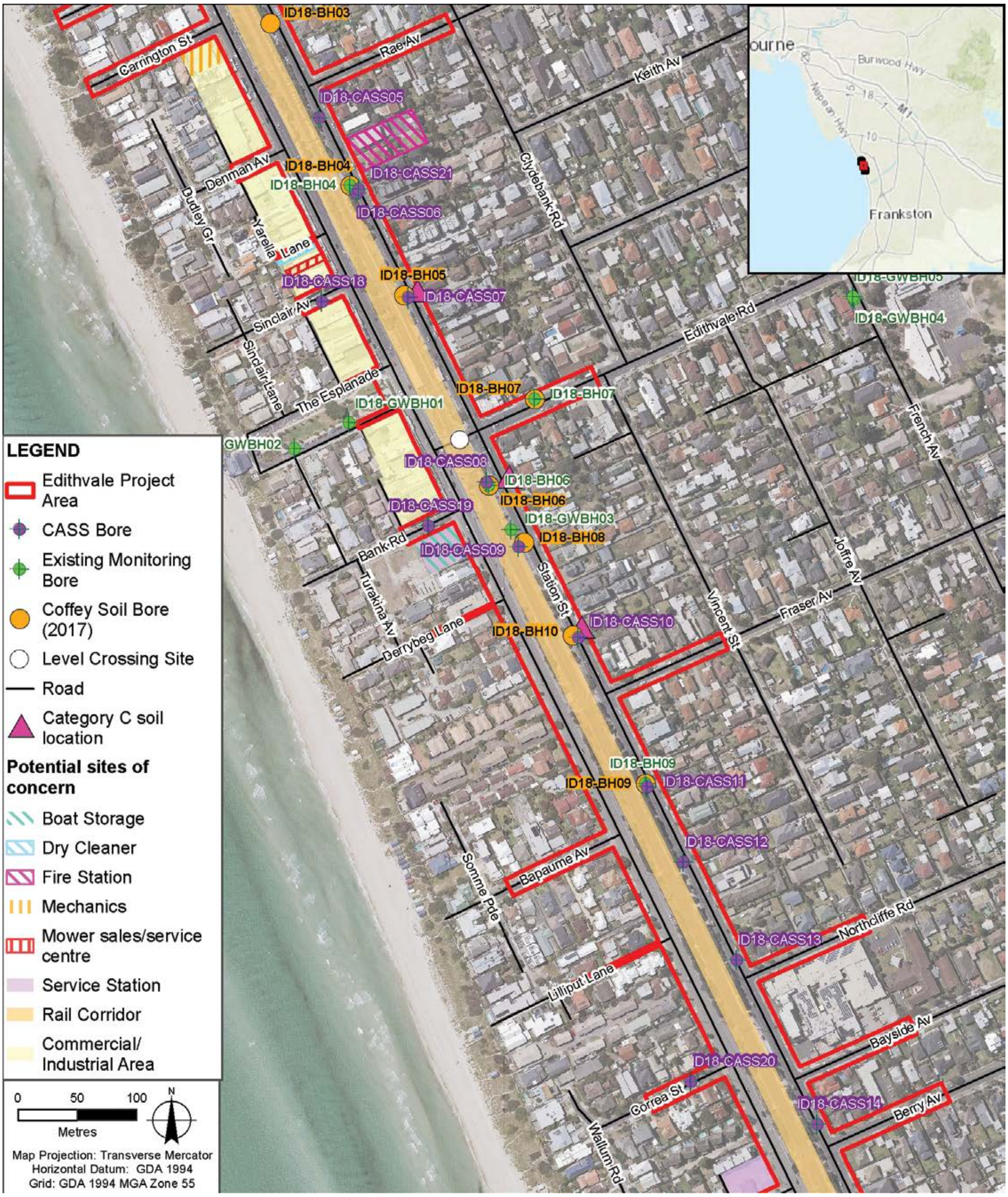


Figure 7.4 Part C: Potential contamination sources (Edithvale)

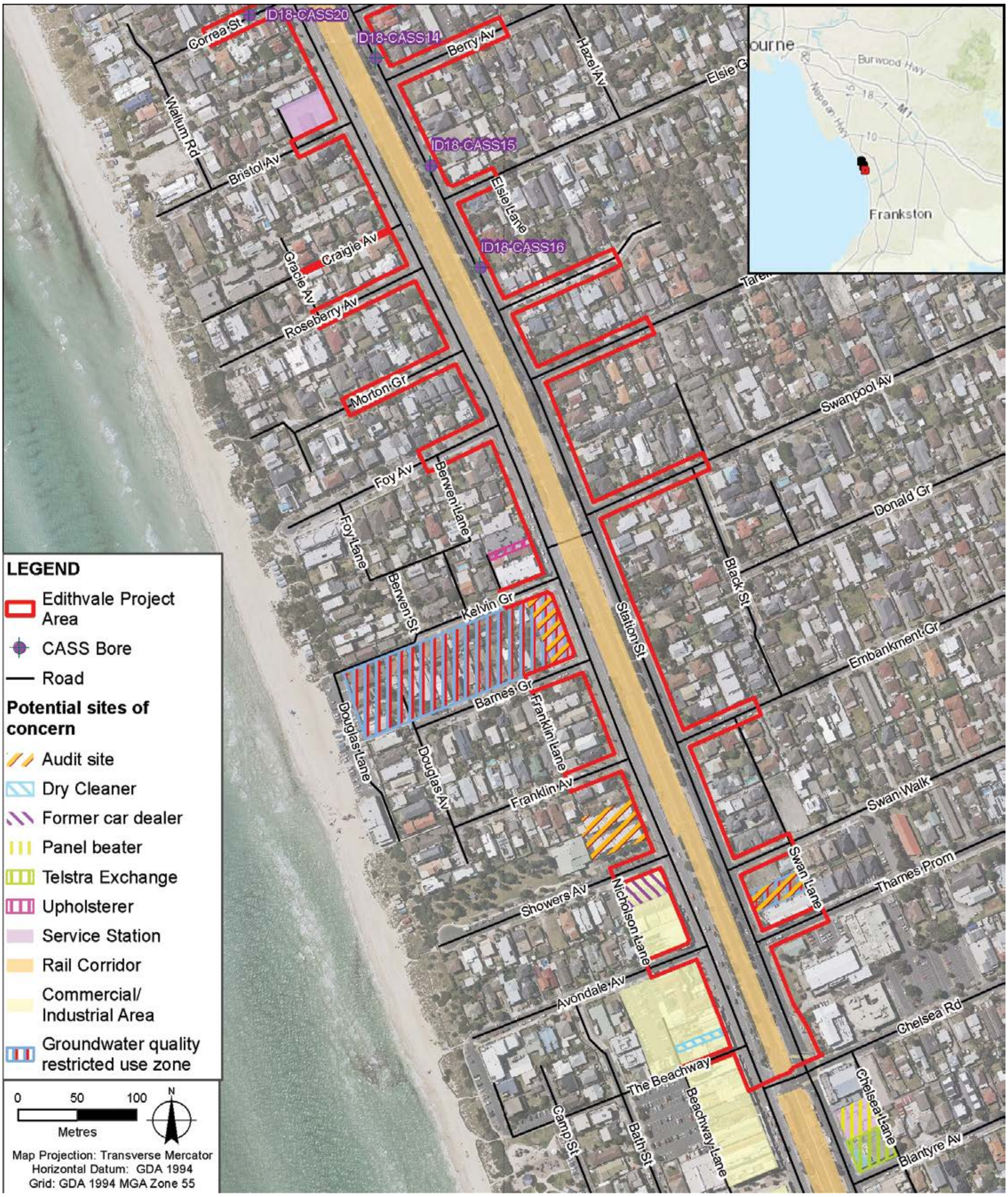


Figure 7.5 Part A: Potential contamination sources (Bonbeach)

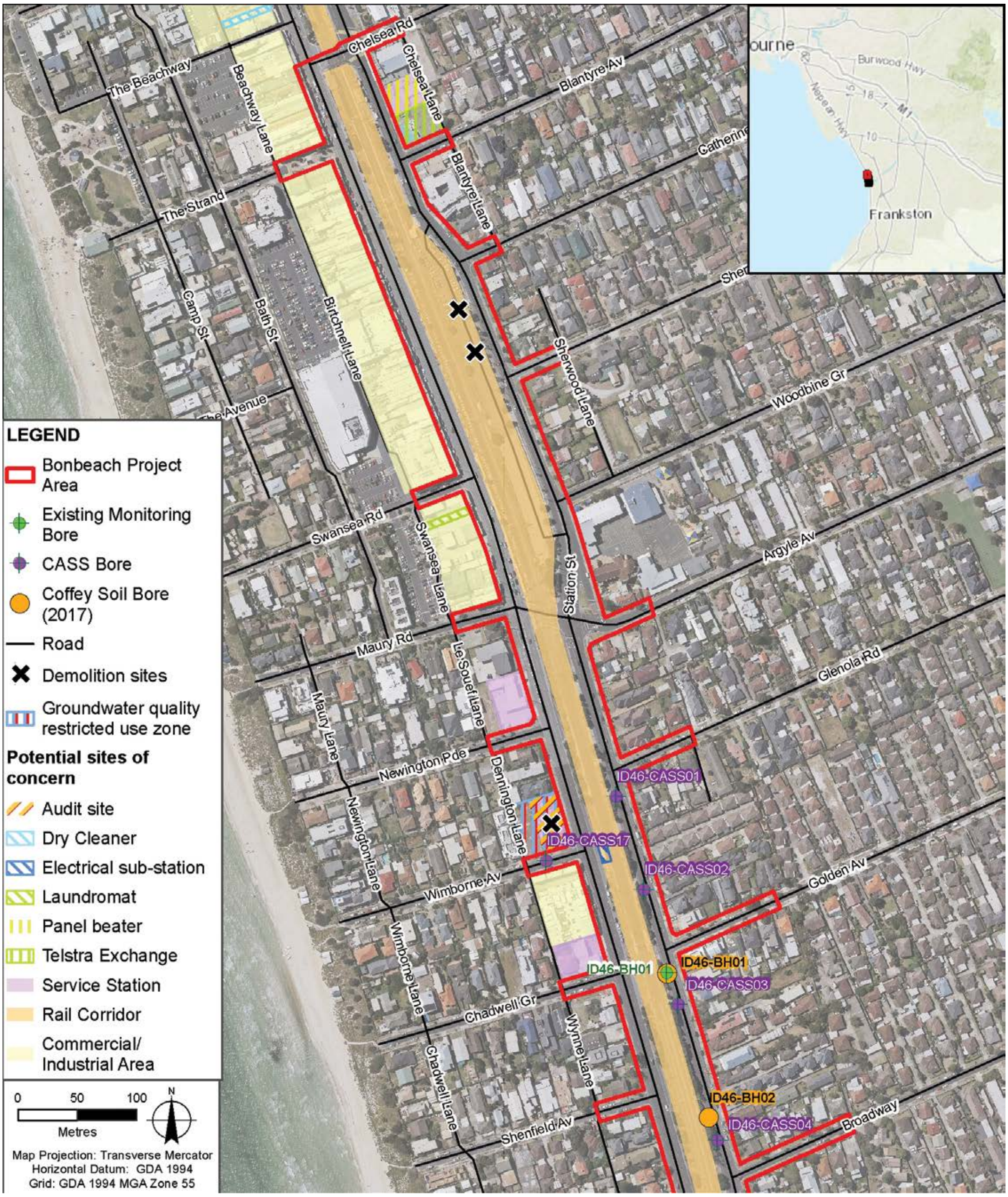


Figure 7.5 Part B: Potential contamination sources (Bonbeach)

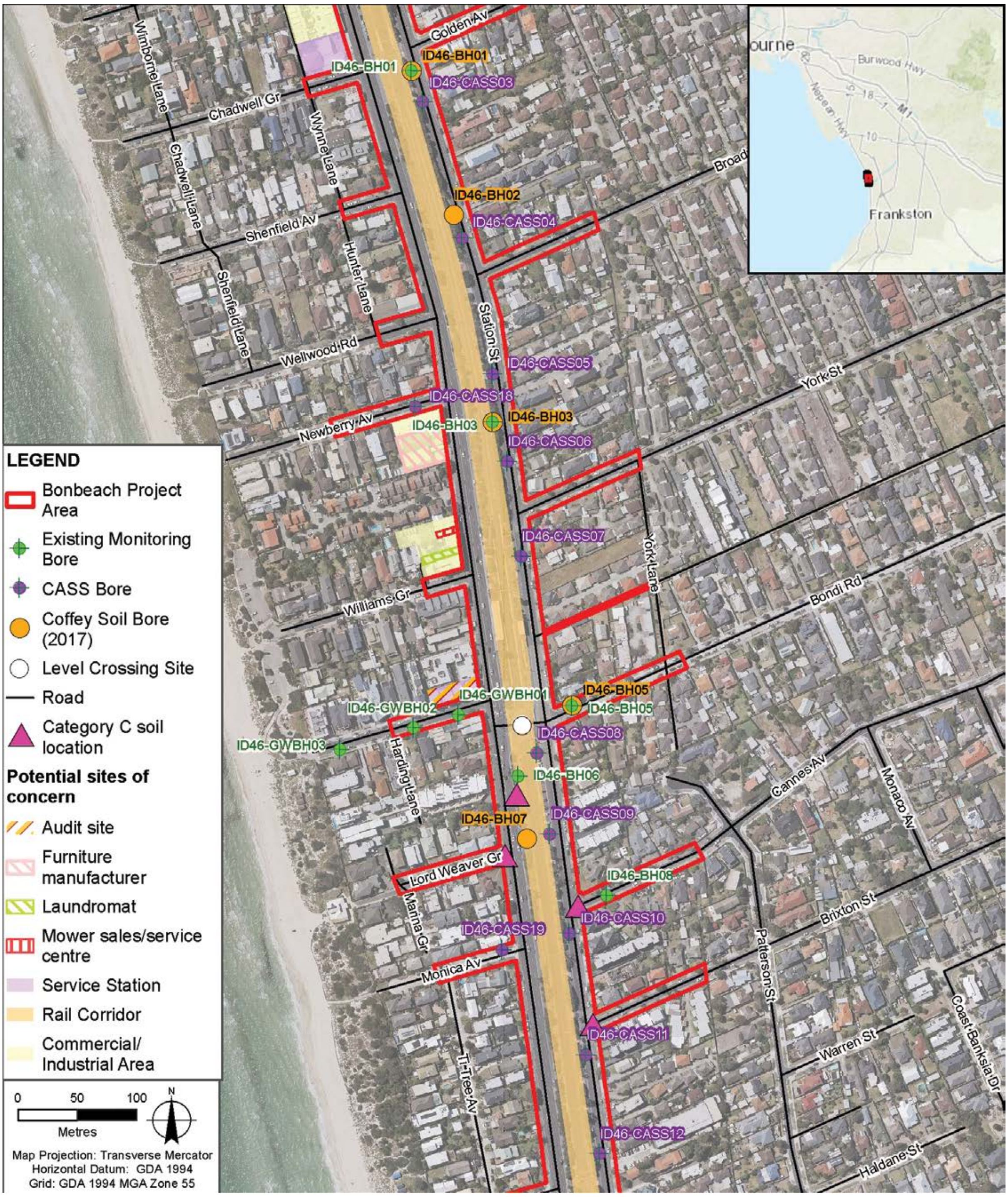
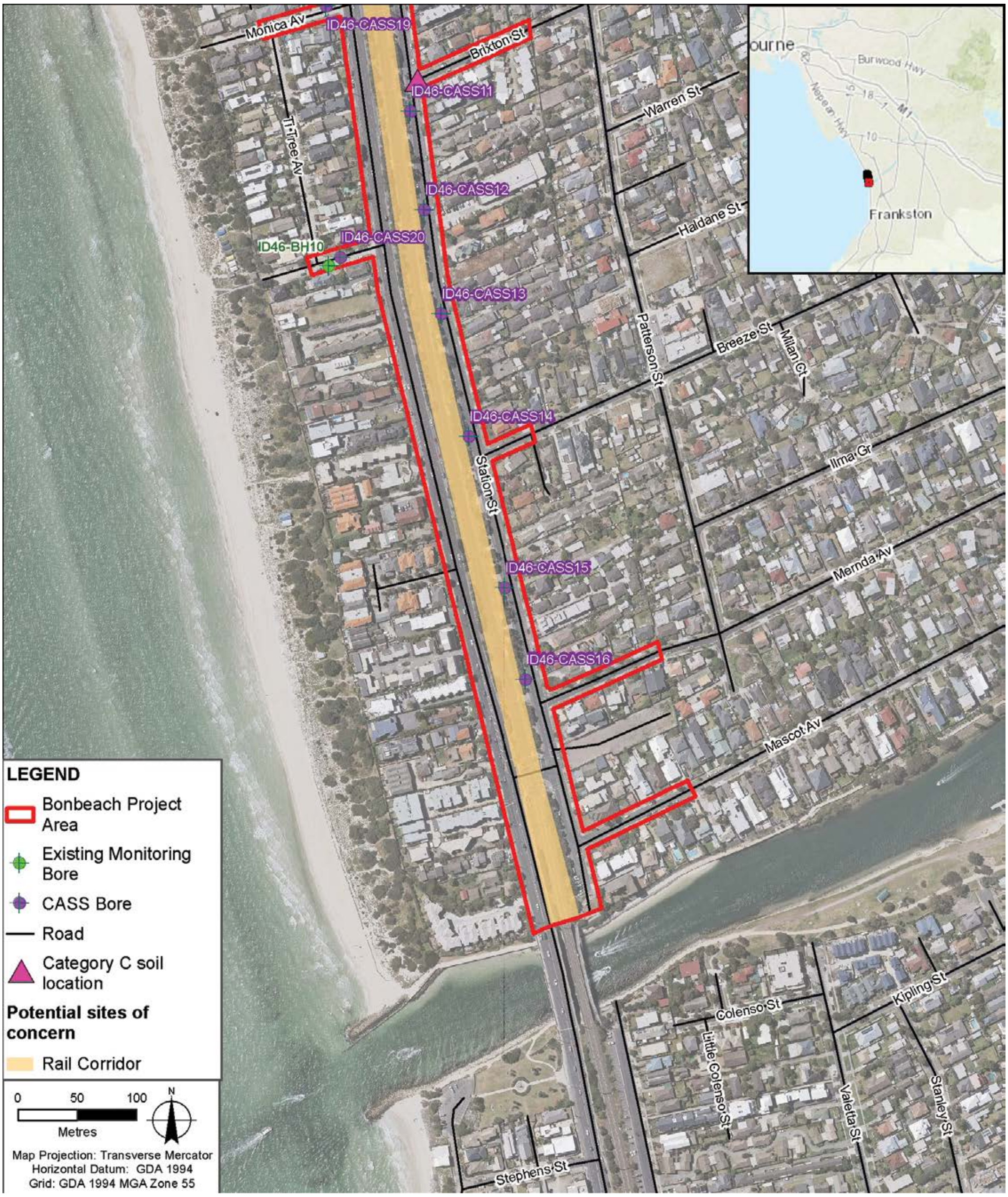


Figure 7.5 Part C: Potential contamination sources (Bonbeach)



Following the desktop assessment and site inspection, an indicative soil and groundwater investigation was undertaken in conjunction with the intrusive acid sulfate soils investigation. The results of the intrusive soil and groundwater investigations have been used to inform the EES conclusions with respect to identifying the likelihood of contamination being present, but not to classify spoil for waste disposal purposes. To classify spoil for waste disposal purposes in accordance with EPA guidelines, further detailed intrusive investigation, targeted to the potential sources of concern, would be undertaken prior to any excavation (EPR references CL1 and CL2).

Soil sampling results

The soil sampling program consisted of 35 soil samples from the Edithvale project area and 48 soil samples from Bonbeach. A previous soil sampling program consisting of 43 soil samples at Edithvale and 43 at Bonbeach was also undertaken prior to the EES commencing.

The soil sampling programs at Edithvale identified:

- the presence of imported or disturbed fill material between the surface and 0.7 metres below ground surface
- concentrations of contaminants in six locations that would classify the material as Category C contaminated soil
- detectable concentrations of PFAS in three locations in the vicinity of the Edithvale fire station
- The different types of spoil categories are described in Section 7.4.3.

The soil sampling programs at Bonbeach identified:

- the presence of imported or disturbed fill material between the surface and 0.3 metres below ground surface
- concentrations of contaminants in nine locations that would classify the material as Category C contaminated soil
- The presence of imported or disturbed fill material, as well as the samples characterised as Category C contaminated soil, indicates that this material has either been imported from an unknown source and has the potential to have been contaminated at its point of origin, during handling and transport or while being placed at its current location. It is therefore assumed that all the imported or disturbed fill material in the project area would be Category C contaminated soil, which would require disposal at a licenced facility. These results further support the findings of the desktop assessment that the project area contains sources of contamination, which have resulted in contaminated soil in the upper portions of the soil profile.

Category C is the lowest classification of contamination within the EPA soil classification guidelines and can be readily managed to minimise adverse impacts by adopting best practice management techniques, such as disposal to an appropriately licenced facility, or treatment subject to the nature and concentrations of contaminants (EPR reference CL1). Based on the desktop assessment, there is also a risk that there could be small amounts (less than 0.1 per cent) of Category B and Category A contaminated soils, associated with the substation at Bonbeach. These are higher classifications of contamination and require specialised handling and treatment, in accordance with EPA Victoria's *Industrial Waste Regulation Guidelines*. All other soil samples analysed in the indicative soil sampling program, other than those where actual or potential acid sulfate soils were observed (refer to Section 7.4.1), were within the criteria for 'clean fill'. These samples tended to be in the deeper portions of the soil profile where soil has not been disturbed or impacted by historic land uses. This accounts for the majority (71 per cent at Edithvale and 73 per cent at Bonbeach) of the total material to be excavated.

Groundwater results

The groundwater investigations at the project sites sampled 11 groundwater monitoring bores at Edithvale and 12 at Bonbeach (23 bores in total). The groundwater investigation at both Edithvale and Bonbeach found concentrations of metals in both the upper and lower aquifers which exceeded the levels considered acceptable for the following groundwater beneficial uses:

- maintenance of ecosystems
- potable water supply
- agriculture, parks and gardens
- stock watering.

Refer to Chapter 5 *Modelling the water environment* for a description of groundwater beneficial uses at the project sites.

Other groundwater contamination issues noted at Edithvale and Bonbeach during the investigation included:

- per-and polyfluorinated alkyl substances (PFAS) in two bores in the vicinity of the fire station at Edithvale above the freshwater ecosystem and drinking water guidelines
- phenol in one bore located near a restricted groundwater use zone
- hydrocarbons and phenols in one bore located near a commercial/industrial area
- phenols and/or volatile organic compounds in three bores located near the rail corridor.

The desktop assessment, supported by the findings of the indicative soil and groundwater investigation, has identified that there are contaminants of concern present in the project areas, but that this is almost exclusively made up of soil likely to be classified as Category C which can be readily managed using well established construction management techniques and compliance with EPA guidelines. A targeted soil and groundwater contamination assessment would occur prior to the works commencing (EPR references CL1 and CL4) to inform management of contaminated soil and groundwater, and to comply with EPA requirements for the testing and categorisation of spoil before it is removed from site. The targeted assessment would take into account land use history to understand the potential impacts to the environment and human health and a systematic sampling program would be developed to categorise spoil for waste disposal purposes.

7.4.3 Spoil generation and assessment

Spoil is waste soil or rock produced during excavation and construction activities. Once generated, spoil is classified by its hazard categorisation so that it can be managed in accordance with the current environmental legislation. The table below summarises the key spoil classifications that would apply to this project.

Spoil hazard classification

Under Victorian legislation, producers of contaminated spoil must categorise their spoil into one of four categories: Category A, B, C or clean fill. The categorisation determines the management options (for example reuse or disposal) that are available for that material.

Spoil must be sampled in accordance with the Industrial Waste Resource Guidelines, and then assessed against the thresholds set by the Victorian EPA. The following table summarises spoil hazard classification categories in Victoria.

Spoil hazard category	Description	Management options
Clean fill	Non-hazardous fill material that may include soil, rock and stone from naturally occurring materials.	Use of fill material is not regulated; however, must take into account general obligations (under the *Environment Protection Act 1970*) to prevent adverse impacts on the environment and human health.
Category C	The lowest class of prescribed industrial waste or contaminated soil.	Accepted at a number of licensed landfills in Victoria, once the landfill has reviewed analytical results and agreed to accept the soil.
Category B	Contaminated soil categorised between Category A and C.	Accepted at only one licensed landfill and/or a limited number of treatment facilities in Victoria.
Category A	The highest class of prescribed industrial waste and cannot be disposed of to landfill without being treated.	Must be treated either onsite or offsite, or stored pending availability of an appropriate treatment technology. Once treated (or partially treated) the soils may be reclassified and, if appropriate, retained on site or disposed of to a licensed facility.

Modelling estimates that 358,094 cubic metres of excess spoil is expected to be produced during the excavation and construction works for the Edithvale and Bonbeach projects. These volume calculations have had a 'bulking density' factor applied to them to allow for the expansion of the material when it is excavated, also referred to as ex-situ volumes. Spoil would be generated during the following construction activities:

- site establishment including:
  - stripping and clearing within the project area
  - establishment of site fencing, staff facilities and lay down areas
  - installation of access roads
- excavation for piling, foundations and the rail trench
- removal of existing level crossing infrastructure.

The estimated spoil volumes based on the desktop and indicative soil contamination investigations, and developed using a three-dimensional model, are given below:

Table 7.3 Spoil volumes

Spoil category	Edithvale level crossing removal (m^3 ex-situ)	Bonbeach level crossing removal (m^3 ex-situ)
Fill material	120,341	145,639
Solid inert waste	0	0
Contaminated soil – Prescribed industrial waste		
Category A	0	50
Category B	0	50
Category C	11,440	28,704
Waste acid sulfate soil	43,355	8,515
Total	**175,136**	**182,958**

Given the constrained nature of the project sites, there is limited opportunity to re-use spoil on the site and the best option for managing spoil is to dispose of it at an appropriately licensed facility, most likely a landfill. It is anticipated that spoil would be tested before it is excavated and removed directly from site to an appropriately licensed facility.

7.4.4 Landfill capacity assessment

As there are a number of other large infrastructure projects happening in Melbourne at the same time (including the Melbourne Metro Rail Tunnel Project and the Westgate Tunnel Project), a high-level assessment of the capacity of the existing landfills in Melbourne (and surrounds) to handle the volume of spoil materials generated by the three projects (this project, the Melbourne Metro Rail Tunnel Project and the Westgate Tunnel Project) was undertaken to ensure there is enough space available to take the material. The findings of this assessment are summarised below:

- For these three projects, 73 per cent of spoil is estimated to be categorised as fill material. As the use of fill material off-site is not regulated and is not required to be disposed at an EPA licenced landfill, it is considered that there is sufficient capacity to manage the combined estimated volume of fill expected to be generated.
- There is considered to be sufficient capacity within EPA licenced landfills to accommodate the approximate 358,094 cubic metres (ex-situ) of Category C contaminated soils to be generated during the three projects. This could be further reduced by application of treatment technologies to reduce contaminant concentrations and/or leachability to allow for Category C soils to be reclassified as fill material post treatment. Furthermore, Category A and B soils can also potentially be reclassified as Category C soils post treatment. Reclassification of material would require additional testing and application to EPA Victoria.

- Offsite disposal of waste acid sulfate soil can only occur at a premise that is licenced to accept waste acid sulfate soil in accordance with the *Environment Protection Act 1970*. The Act provides a framework for preventing and controlling air, land and water pollution as well as noise, increasing resource efficiency, reducing waste and improving environmental performance. There is considered to be sufficient capacity within EPA licenced and/or approved facilities to accommodate the approximately 878,670 cubic metres (ex-situ) of waste acid sulfate soil to be generated during the three projects, of which approximately 6 per cent is expected to be generated by the Edithvale and Bonbeach level crossing removal projects.

Overall, the volume of spoil produced by the projects, and the subsequent landfill space required, is considered minor in the context of the other major infrastructure projects occurring in Melbourne. Given the amount of spoil to be generated by the projects, it is unlikely that sourcing an appropriate disposal facility for the spoil would be an issue.

7.5 Construction impact assessment

Construction activities at both the Edithvale and Bonbeach level crossing removal projects would be minimised within the project areas to reduce disruption outside the works area (for example on adjacent roads). Additionally, the project design of a trench does not require fill for its construction. As such, there is not expected to be any opportunity to re-use the spoil from the excavation, and disposal at an appropriate facility is considered the primary option to manage spoil.

Acid sulfate soils

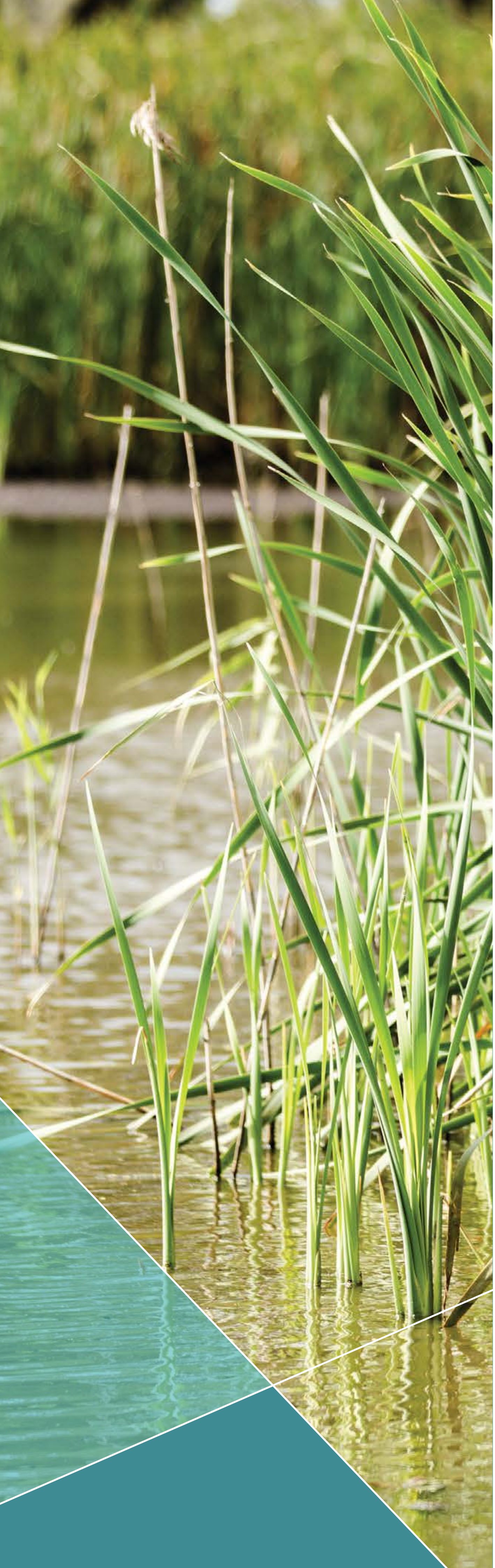
The spoil assessment modelling has indicated that approximately 14 per cent of the total soil excavated or 51,870 cubic metres (ex-situ) is considered likely to be waste acid sulfate soils. This estimate is based on regional geology as well as the sampling program results and therefore is considered to be a reliable prediction of what would likely be encountered.

When exposed to the air, acid sulfate soils can produce sulfuric acid. The oxidation of acid sulfate soils can result in the generation, mobilisation and migration of acidity which can liberate contaminants (for example nutrients and metals) and potentially impact the environment, in-ground structures and human health. Once released from the soil profile, sulfuric acid and its subsequent impacts (discussed further below) can persist in the environment for as long as the sulfuric acid is being generated.

Contaminated soil

Based on the desktop investigation and field investigations undertaken, it is expected that some of the soil to be excavated would be contaminated through existing and historical land uses, such as the use of fill material in the rail corridor and adjacent land uses such as a fire station, services stations and drycleaners. Contaminants such as metals, hydrocarbons, asbestos and other industrial chemicals are considered likely to be present in some of the soil excavated. An indicative intrusive investigation was undertaken adjacent to the proposed rail trench to minimise disruption to rail operations and protect the safety of personnel undertaking the field investigations. The results of the investigations are therefore considered to be indicative of the contamination status of the shallow soils to be excavated.

Approximately 11 per cent of the total spoil to be excavated or 40,144 cubic metres (ex-situ) is expected to be categorised as Category C contaminated soil. It has been assumed that approximately 100 cubic metres of soils beneath the substation in the Bonbeach project area (less than 0.01 per cent of the total spoil to be excavated) would be contaminated by Polychlorinated Biphenyls (PCBs) and categorised as either Category A or Category B contaminated soil.



Soil samples obtained in the vicinity of the fire station adjacent to the Edithvale site reported detectable concentrations of PFAS. This material would need to be treated differently to other contaminated soils as landfilling of PFAS-impacted solid wastes is not currently considered to be a suitable waste management solution by EPA Victoria and other alternatives such as treatment, onsite containment or secured temporary storage would need to be considered. The EPA has issued an interim position statement (in October 2017) and is currently considering recommendations for the management of low concentration PFAS contaminated soil. Once it has determined the acceptability of landfill disposal, this information would be made available and landfilling of PFAS material may or may not be considered viable for this project. If it is not considered viable, an appropriate management strategy would be agreed with the EPA, and this could include (in accordance with EPA Victoria's PFAS management hierarchy):

- destruction of PFAS contaminated material
- immobilisation and onsite containment (unlikely to be an option for the projects as the sites are highly constrained)
- immobilisation and offsite removal to a specific landfill cell (agreement would be required from EPA Victoria and the landfill operator).

Risk assessment

The scoping requirements for the EES require the identification and evaluation of the effects of waste acid sulfate soil and contaminated soil on environmental and human health values during construction. The following risks have been identified to provide an analytical framework for addressing this requirement. This section includes an assessment of the likelihood and consequence of the risk occurring.

The identified contamination and acid sulfate soils risks are outlined in the table below. The risks in Table 7.4 would only occur during the construction period and would apply to both the Edithvale and Bonbeach sites. Risks that occur during both construction and operation are addressed in Section 7.6.

Construction risks discussed in Table 7.4 were all assessed as negligible. This is because the desktop and intrusive investigations completed have provided information on the type and volumes of material expected to be encountered. This enables management plans to be developed to guide the handling and management of the material to be excavated, in accordance with the existing policies and guidelines, which would minimise the risk of significant environmental and/or health impacts.

Table 7.4 Risk table – construction

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
CL50	CASS/ contaminated soil (physical environment)	Disturbance, handling, storage or disposal of CASS/contaminated (including asbestos) soil results in adverse health and environmental impacts to land	EPR CL1 – Spoil Management Plan EPR CL2 – Acid Sulfate Soil Management Plan	Negligible	As initial EPR	Negligible
CL51	CASS/ contaminated soil (odour)	Disturbance, handling, storage or disposal of CASS/contaminated soil leads to the generation of odorous material and results in a loss of amenity	EPR CL1 – Spoil Management Plan EPR CL2 – Acid Sulfate Soil Management Plan EPR SC1 – Community and Stakeholder Engagement Management Plan	Negligible	As initial EPR	Negligible
CL52	Contaminated groundwater	Disturbance, handling, storage or disposal of acidic and/or contaminated groundwater results in adverse health and environmental impacts	EPR CL4 – Acidic and/or contaminated groundwater (construction)	Negligible	As initial EPR	Negligible
CL53	Unknown contamination	Unknown contamination encountered during construction results in environmental, health or amenity impacts	EPR CL1 – Spoil Management Plan EPR CL4 – Acidic and/or contaminated groundwater (construction)	Negligible	As initial EPR	Negligible
CL54	Spill	Fuel/chemical spill results in adverse health or environmental impact	EPR CL3 – Waste management	Negligible	As initial EPR	Negligible
CL55	Other waste streams	Management of other waste (solid inert, liquid, organic, packaging and food scraps) results in environmental impact	EPR CL1 – Spoil Management Plan EPR CL3 – Waste management plan	Negligible	As initial EPR	Negligible
CL56	Non-compliance (waste transport/ disposal)	Transport or disposal of CASS and/or contaminated soil is not in compliance with EPA Victoria permit/ licence and results in an environmental impact.	EPR CL1 – Spoil Management Plan EPR CL2 – Acid Sulfate Soil Management Plan	Negligible	As initial EPR	Negligible
CL57*	Contamination (vapour) – Edithvale	Intersection of contaminated soil and/or groundwater resulting in vapour impacts on human health	EPR CL1 – Spoil Management Plan EPR CL2 – Acid Sulfate Soil Management Plan EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR GW3 – Groundwater Management Plan (construction)	Negligible	As initial EPR	Negligible

**Risk CL57 only applies to the project at Edithvale.*

Disturbance, handling, storage or disposal of CASS/contaminated soil (including asbestos)

Adverse health and environmental impacts to land (Risk CL50)

Interaction with acid sulfate soils

The main activities during the construction phase which have the potential to encounter or activate acid sulfate soils in the project areas are installation of the pile walls and excavation of the trenches.

The disturbance of acid sulfate soils is likely to have a negligible risk of impact on human health and the surrounding environment. This is because the likely occurrence of potential acid sulfate soils in the area to be excavated has been established by undertaking a detailed intrusive investigation in accordance with EPA Victoria's Industrial Waste Management Policy 2009 to enable effective management measures to be put in place. The sampling undertaken during the detailed investigation is in accordance with the *Victorian best practice guidelines for assessing and managing coastal acid sulfate soils* 2010 and is therefore considered sufficient to develop an appropriate management plan (including disposal options) to minimise impacts during construction works.

As stated above, the assessment shows that acid sulfate soils are either present or would be generated during the excavation works between four and 15 metres below ground surface at Edithvale and 3.5 and 16 metres below ground surface at Bonbeach. This means that approximately 14 per cent of the total material to be excavated or 51,870 cubic metres (ex-situ) of acid sulfate soils is expected to require management from the project areas.

The management measures for potential acid sulfate soils are outlined below.

Pile installation

Spoil generated by the pile installation would likely contain some acid sulfate soil when it is brought to the surface. The total volume of spoil expected to be generated from piling in both project areas is 65,787 cubic metres (ex-situ) and approximately 48 per cent of this volume is estimated to be waste acid sulfate soils.

The primary proposed management measure would be to remove soil predicted to be acid sulfate soil from the site immediately and transport it to a facility licensed to receive such soils. It is not expected that any acid sulfate soils would be stockpiled on site.

Also, potential acid sulfate soil that is already in the ground may be exposed to air during the piling activities. However, the pile installation process would have minimal time (likely to be less than eight hours depending on pile installation technique) between the spoil being excavated and the pile being installed, and therefore is considered unlikely to activate the potential acid sulfate soils that are not being excavated. A maximum of 18 hours exposure to air without treatment is considered an acceptable timeframe for coastal acid sulfate soils, such as those in the project area, according to the *Victorian best practice guidelines for assessing and managing coastal acid sulfate soils* 2010.

Excavation of the trenches

Excavation of the trenches is likely to activate potential acid sulfate soils generally at 4 metres below ground surface at Edithvale and 3.5 metres below ground surface at Bonbeach. Figure 7.2 and Figure 7.3 show schematic sections of the proposed excavations and the depths where they are expected to intersect with potential acid sulfate soils at Edithvale and Bonbeach. At Edithvale (Figure 7.2), there is high potential of intercepting the potential acid sulfate soils layer during excavation of the rail trench and associated infrastructure. The modelled volume of potential acid sulfate soils likely to be generated at Edithvale is 43,355 cubic metres (ex-situ). At Bonbeach (Figure 7.3) the depths where samples exceeded the acid sulfate soil management criteria are mostly located below the depth of the excavation. As such, at Bonbeach, there is limited potential of intercepting potential acid sulfate soil – approximately 2,000 cubic metres is expected to be generated during excavation of the water storage structure and the associated deeper sections of the trench.

The pile walls on either side of the trench would be constructed prior to excavation of the trench itself. This would prevent any ground or surface water in the trench area from mobilising into the surrounding groundwater environment. This would effectively prevent acidic water (generated by contact between water and exposed acid sulfate soils) from contaminating existing groundwater or soils adjacent to the trench while it is being excavated. The pile walls would extend several metres below the deepest excavation point which would also prevent the potential for contamination as a result of the activation of acid sulfate soils.

Interaction with contamination

Due to the land uses history of the project areas and their surrounds, and elevated concentrations of contaminants of concern identified in shallow soils adjacent to the construction areas, it is expected that contaminated soils would be encountered during the excavation works. Approximately 11 per cent of the material to be excavated is expected to be classified as contaminated soil.

The disturbance of contaminated soils is considered likely to have a negligible risk of impact on human health and the environment; this is because soil material to be excavated would be categorised prior to excavation through an in-situ sampling program in accordance with EPA Victoria Industrial Waste Resource Guidelines (IWRG) and Australian Standards before being removed from the site to a licenced landfill or treatment facility.

Due to the limited space within the construction boundary, there would be no opportunity to re-use or stockpile the excavated soils and as such, all soils would be transported directly off site, minimising the risk of adverse health and environmental impacts to the community.

Management measures for acid sulfate soils and contamination

Given the constrained sites and the need to construct the trenches within the existing rail alignment, there is no opportunity to move the locations of the piled walls of the trench to minimise the amount of potential acid sulfate soil or contaminated soil encountered.

The primary proposed management measure would be to remove soil predicted to be acid sulfate soil, contaminated soil and other excavated material from site immediately and transport it to a facility licensed to receive such soils.

The following management measures would be embedded in the EPRs (EPR references CL1 and CL2) to manage risk of the disturbance, handling, storage or disposal of CASS/contaminated soil that could result in adverse health and environmental impacts to the community:

- A Spoil Management Plan would be developed and implemented that includes, but is not limited to:
  - applicable regulatory requirements
  - identifying the nature and extent of spoil (clean fill and contaminated spoil) across the construction areas
  - roles and responsibilities
  - identification of management measures for storage, handling and transport of spoil for the protection of health and the environment
  - identification, design and development of specific management measures for temporary stockpile areas
  - identifying potential sites for management for disposal of any spoil
  - monitoring and reporting requirements
  - identifying locations and extent of any prescribed industrial waste (PIW) (including asbestos) and characterising PIW prior to excavation
  - identifying suitable sites for disposal of PIW.

The Spoil Management Plan would include sub-plans as appropriate, including an Acid Sulfate Soil Management Plan (EPR reference CL2).

- An Acid Sulfate Soil Management Plan would be prepared prior to construction of the project as a sub-plan of an overarching spoil management plan in accordance with the *Industrial Waste Management Policy (Waste acid sulfate soils)* 1999, and EPA Publication 655.1 *Acid sulfate soil and rock*. The sub-plan would also be in accordance with EPA regulations, standards and best practice guidelines and be prepared in consultation with the EPA. This sub-plan would include:
  - identifying locations and extent of potential acid sulfate soils
  - assessing potential risk and impact for human health, odour and environment
  - identifying and implementing measures to prevent oxidation of acid sulfate soil wherever possible
  - identifying suitable sites for management or disposal of acid sulfate soil.

Generation of odorous material results in a loss of amenity (risk CL51)

Odorous material can be generated when soils containing sulphides are exposed to air and hydrogen sulphide is produced (also known as rotten egg gas) or contaminated soil containing odorous wastes (such as petroleum hydrocarbon impacted soils) are excavated and exposed to air. While such soils are exposed, either by excavation, in stockpiles or on the side of a trench, they can continue to emit odour that could be considered unpleasant by people in the area. The odour can also be spread outside of the project area as material is transported off-site or during strong winds. This can lead to a loss in amenity (for instance people not wanting to be in the vicinity) for the surrounding area.

Given that the potential presence of contaminated and acid sulfate soils has been identified in the construction area, it is considered likely that the spoil excavation process would expose odorous material, however, the risk that it would result in a loss of amenity is considered negligible. This is because the material is not proposed to be stockpiled on site and unexcavated soil would be managed to minimise odours during the excavation period, when odorous material would be exposed (for example before the concrete slab is installed in the base of the trench). Furthermore, the exposure of any odorous material would be temporary and limited to the main occupation of the rail corridor (estimated to be six-weeks, see Chapter 2 *Rationale and project descriptions*).

Management of spoil in accordance with EPR_CL1 and EPR_CL2, as described above, would also minimise the impacts of odour on surrounding amenity. There are additional measures that would be undertaken to minimise odour impacts during the excavation and transportation of spoil including but not limited to:

- periodic monitoring of the aesthetics of the material excavated and proposed for transportation
- if odorous material is identified, it must be segregated and odour emissions assessed with the appropriate gas monitoring equipment
- if trigger levels are exceeded, implementing appropriate occupational health and safety measures
- odour mitigation measures must be put in place prior to transporting the material off site for treatment and/or disposal. This may include spraying the material with an odour neutralising agent.

In addition to the measures described above, a Community and Stakeholder Engagement Management Plan (EPR reference SC1) would be used to let surrounding users know of the potential impacts associated with the construction occupation period, including odour.

Disturbance, handling, storage or disposal of acidic and/or contaminated groundwater

The disturbance of acidic and/or contaminated groundwater is considered likely to have a negligible risk of impact on human health and the environment. This is because the projects are not likely to need to manage a significant amount of groundwater.

Groundwater impacted by the projects would be limited because the deep pile walls that support the sides of the proposed trench would be inserted prior to the excavation of the trench. The pile walls would prevent groundwater entering the excavated area. This means that only ground water trapped between the two pile walls would need to be removed from the trench as a result of construction. A conservative estimate (based on spoil volumes to be excavated and groundwater flow rates) of the volumes of groundwater expected to be removed from the excavations is 20,800 litres at Edithvale and 21,700 litres at Bonbeach.

Any contaminated groundwater encountered during the excavation would be a result of the historic land uses within the project areas and their surrounds, and elevated concentrations of contaminants of concern in groundwater adjacent to the construction areas. The groundwater was found to be slightly acidic to neutral in the shallow aquifer during the groundwater investigation completed for this EES. There is also a possibility for the potential acid sulfate soils present in the project areas to generate acidity when exposed to air during the excavation. This acidity can alter the groundwater quality at a particular area.

Groundwater can be readily managed through well-established construction management techniques. The projects would be required to develop and implement measures to manage acidic and/or contaminated groundwater during construction, to EPA Victoria requirements, including (EPR reference CL4):

- a baseline groundwater quality assessment (taking into account site history) at least three months prior to commencement of trench excavation
- implementing a system to manage and/or dispose of intercepted groundwater (if required) which may be a trade waste agreement (TWA) with the relevant utility authority or other measures in accordance with relevant guidelines and legislation (if a TWA is not granted)
- collection, treatment, disposal and handling of contaminated groundwater and/or slurries including vapours
- monitoring of intercepted groundwater quality
- implementing contamination plume management (if required)
- treating and monitoring impacted groundwater (including vapours) prior to disposal in accordance with licence and/or agreement.

The risk of an adverse environmental impact resulting from contaminated or acidic groundwater being released into the environment is considered negligible. This could occur if groundwater was allowed to soak back into the ground or discharged untreated to stormwater or a surface water body. Adverse human health impacts could result if skin contact or ingestion of contaminated or acidic groundwater occurred.

These risks are considered negligible because they would be managed in accordance with EPR CL4 which includes a requirement for a pre-construction baseline groundwater assessment to understand the condition of the groundwater including identifying contaminants of concern and concentrations prior to excavation and disposing of any groundwater encountered during construction in accordance with EPA requirements. The most likely option for disposing of this water would be a TWA with the relevant utility authority to dispose of treated water off-site to sewer. Treatment and monitoring of impacted groundwater would occur prior to disposal to sewer in accordance with the TWA.

There is expected to be minimal opportunity to interact with groundwater outside the construction footprint during construction. The current construction technique would include the installation of a cut off wall prior to the commencement of excavation to prevent the ingress or egress of groundwater into or from the construction zone.

Unknown contamination (risk CL53)

It is possible that unknown contamination would be encountered during construction. The risk to the environment, health or amenity as a result of interaction with unknown contamination is assessed as being negligible. This is because all soil to be removed would be tested before it is excavated (known as an in-situ intrusive soil investigation) in accordance with EPA Victoria Industrial Waste Resource Guidelines and Australian Standards for sampling.

A baseline groundwater assessment to understand the groundwater condition including contaminants of concern and concentrations, would be completed prior to excavation works commencing (EPR references CL1 and CL4). This would minimise the potential for unknown contamination to be encountered during construction. The investigation would be completed prior to the trench excavation commencing and would be designed to obtain a thorough understanding of the soil character. Excavation between the pre-constructed pile walls would also reduce the risk of any contamination leaving the project site in an uncontrolled manner as the pile walls provide an effective containment system.

Fuel/chemical spill (risk CL54)

During construction, vehicles, plant and machinery would be operating within the construction zone. There is a possibility that spills may occur during the refuelling of vehicles, plant and machinery or through the use of chemicals required as part of the construction process.

The risk of such a spill being extensive enough to result in a significant adverse health or environmental impact is assessed as being negligible. This is because the following management measures, included in a Construction Environmental Management Plan (CEMP) (EPR reference CL3) would be in place:

- refuelling of vehicles in designated areas only and management of the areas to ensure any spill can be contained
- minimising fuel and other fluids stored on site
- provision of spill kits with apparatus to contain any spill at the construction site and fuel storage areas to enable rapid management of spills
- ensuring staff are trained in spill containment and in using the spill kits provided
- use of well-maintained plant to minimise the potential for spills to occur
- development of procedures to remove, treat and/or dispose soil that becomes contaminated due to a fuel or chemical spill.

Management of other waste (solid inert, liquid, organic, packaging and food scraps) (risk CL55)

Waste other than soil and groundwater would be generated by the projects at the construction site. These wastes are expected to be generated by daily activities such as material deliveries, washing and meal times. If these wastes are not appropriately contained, they could be released into the environment resulting in adverse impacts (as described above). The projects would be required to develop and implement a Waste Management Plan as part of a CEMP (EPR reference CL3). The risk of other waste being discharged into the environment and resulting in a significant adverse impact is considered negligible with the following measures included in the CEMP to specifically mitigate this risk:

- site induction for all construction personnel outlining waste management requirements (such as the use of waste and recycling facilities and maintenance of a clean site policy)
- appropriate chemical management procedures such as minimising use and storage of chemicals on site and use of bunded storage facilities
- storing litter, particularly that which is able to be windblown or is putrescible, in a lidded bin from which material cannot escape
- containing washing residues, slurries and other contaminated water within designated areas, including appropriate treatment and/or disposal
- designating vehicle-washing areas
- using temporary fencing as a secondary containment measure for litter
- adopting the waste management hierarchy consistent with the *Environment Protection Act* 1970 in assessing waste management options.

Transport or disposal of CASS and contaminated soils (risk CL50 and CL51)

In accordance with the spoil assessment (EES Technical Report C *Acid sulfate soils and contamination*), there is estimated to be 358,094 metres cubed (ex-situ) of spoil generated by both projects. Spoil excavated from the site (including contaminated soil and acid sulfate soil) would require transport and disposal to an appropriately licensed facility.

A preliminary assessment of the spoil breakdown has indicated there is sufficient capacity available in landfills in Victoria to accept the type of spoil generated (fill material, acid sulfate soils and Category A, B and C contaminated soils). The projects would be required to prepare and implement a Spoil Management Plan (EPR reference CL1) and an Acid Sulfate Soil Management Plan (EPR reference CL2). The risk of non-compliance with EPA Victoria guidelines resulting in a significant adverse impact to the environment is considered negligible with the following measures included in the plans to specifically mitigate this risk:

- sampling and analysing soil material to be excavated prior to excavation in accordance with EPA Victoria Industrial Waste Resource Guidelines (IWRG) and Australian Standards for sampling, and determining transport and treatment requirements, if any, prior to disposal or reuse
- identifying soil containing asbestos fibre to enable appropriate handling and transport
- identifying suitably licenced facilities for the disposal of soil material generated
- management of contaminated soil within the project area to ensure material is segregated according to its transport and disposal requirements
- a tracking system that allows verification of the suitability of soil movement from the site to a licensed landfill or treatment facility
- specification of the type of vehicles to be used for waste movements
- measures to ensure transport certificates/records are completed and maintained on file.

Soil and/or groundwater vapour (risk CL57)

Vapours associated with contaminated soil and/or contaminated groundwater that could be encountered during the trench excavation has the potential to impact human health. This is considered to be a negligible risk because there would be minimal opportunity for the general public to interact with vapours from contaminated soil or contaminated groundwater. Volatile contaminants (such as those generated by a fuel plume in groundwater) may be present in the soil and/or groundwater due to existing contamination. Depending on the contaminant concentration and depth, the contaminants may not be present at the surface.

Excavation of surface soils during construction has the potential expose volatile contamination at depth, creating a pathway for gases and vapour to migrate from a subsurface source of vapour-forming chemicals into buildings or other enclosed spaces via cracks in the foundation and/or openings for utility lines. The indicative contamination assessment undertaken as part of this EES identified possible sources of vapour-forming chemicals in the vicinity of the project area, for example service stations. Exposure to soil vapours can have an adverse impact to human health through the generation of odour, inhalation or flammability.

Vapour impacts are generally associated with a build-up of vapours in a confined space. As the trench construction methodology would be an open trench, vapours released during the excavation would readily dissipate, minimising the potential for vapour to impact the health of the general public.

To further mitigate the potential for the project to generate a vapour risk, a targeted soil and groundwater investigation (EPR references CL1 and GW3) would be undertaken prior to excavation commencing. In the areas that have been identified as potential sources for vapours (for example in the vicinity of service stations), the results would indicate the level of volatile organic compounds present in the soil and/or groundwater. This would guide the requirement for further management which would also assess the risk of human health impacts.

Based on the current understanding of the potential sources of vapour-forming chemicals and the construction methodology, the likelihood of adverse impacts is considered negligible. Undertaking further targeted assessment within the construction footprint would provide greater certainty around the potential for adverse human health impacts, maintaining the risk level at negligible.

7.6 Operation impact assessment

The acid sulfate soils and contamination impacts identified for the operations phase of the Edithvale and Bonbeach level crossing removal projects are outlined below. The potential impacts described in Table 7.5 would commence from the installation of the pile walls but would continue into the operation phase and are therefore assessed as operational risks.

An assessment of risks and impacts posed by the projects was undertaken in accordance with the method described in Chapter 4 *Assessment framework*. An initial risk assessment was undertaken to assess potential risks to the environment arising from the implementation of the project at Edithvale. As discussed in Chapter 5 *Modelling the water environment*, through the risk and impact assessment process, a need to manage groundwater at Edithvale was identified to reduce the potential changes to groundwater levels caused by the pile walls and associated impacts.

To manage potential impacts predicted through the initial assessment, an EPR was developed which would reduce the magnitude and extent of project-induced groundwater level changes at Edithvale (EPR reference GW2). An engineering solution was developed and modelled to demonstrate that a mitigation measure could be adopted to minimise the impact of the project on groundwater levels to the extent that the performance outcomes in EPR_GW2 could be achieved.

As discussed in Chapter 5 *Modelling the water environment* the predicted groundwater mounding and drawdown, and the associated impacts, at Bonbeach are significantly less than those modelled at Edithvale. The groundwater flow direction is different at Bonbeach and no mitigation measures are required at this location. This is reflected in the consistency of risk levels between the initial and residual risks at Bonbeach in the table below.

Table 7.5 Risk table – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW60	CASS activation – Edithvale	Drawdown on the down gradient side of trench and mounding on up gradient side of the trench could result in changes in groundwater levels, which could give rise to activation of CASS and/or mobilise any existing acidity and groundwater acidification affecting beneficial uses of land and groundwater.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Moderate	EPR GW1 – Rail trench design EPR GW2 – Groundwater EPR GW4 – Groundwater Management and Monitoring Plan EPR CL5 – Acidic and/or contaminated groundwater (operation)	Negligible
GW62	Contaminant migration – Edithvale	Mounding on the up gradient side of trench, drawdown on down gradient side of trench, and groundwater physically diverted either to the north or south along the up gradient side of the trench could alter contamination plume migration, adversely impacting on beneficial uses of land and groundwater.	EPR GW1 – Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – Spoil Management Plan EPR CL4 – Acidic and/or contaminated groundwater (construction)	Moderate	EPR GW1 – Rail trench design EPR GW2 – Groundwater EPR GW4 – Groundwater Management and Monitoring Plan EPR CL1 – Spoil management plan EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR CL5 – Acidic and/or contaminated groundwater (operation)	Minor
GW67	CASS activation – Bonbeach	Drawdown on the down gradient side of trench and mounding on upgradient side of the trench could result in changes in groundwater levels, which could give rise to activation of CASS and/or mobilise any existing acidity and groundwater acidification affecting beneficial uses of land and groundwater.	EPR GW1 – Rail trench design (Edithvale and Bonbeach) EPR GW3 – Groundwater Management and Monitoring Plan	Minor	EPR GW1 – Rail trench design (Edithvale and Bonbeach) EPR GW2 – Groundwater EPR GW4 – Groundwater Management and Monitoring Plan EPR CL5 – Acidic and/or contaminated groundwater (operation)	Minor

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
GW69	Contaminant migration – Bonbeach	Mounding on the up gradient side of trench, drawdown on down gradient side of trench, and groundwater physically diverted either to the north or south along the up gradient side of the trench could alter contamination plume migration adversely impacting on beneficial uses of land and groundwater.	EPR GW1 – Rail trench design (Edithvale and Bonbeach) EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – Spoil management Plan EPR CL4 – Acidic and/or contaminated groundwater (construction)	Negligible	EPR GW1 – Rail trench design (Edithvale and Bonbeach) EPR GW2 – Groundwater EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – Spoil management plan EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR CL5 – Acidic and/or contaminated groundwater (operation)	Negligible

Potential activation of CASS and groundwater acidification from groundwater drawdown (risk GW60 and GW67)

Groundwater modelling undertaken as part of the groundwater impact assessment shows that the installation of the pile walls on both sides of the trench at Edithvale and Bonbeach would change the groundwater levels and result in a fall in groundwater levels (known as drawdown) to the west of the rail trench and a rise in groundwater levels (known as mounding) to the east of the rail trench. Drawdown and mounding would commence within months of installing the pile walls and would continue over the life of the trench.

As described in Section 7.4.1, potential acid sulfate soils have been identified in the project area. Some of the potential acid sulfate soils are located at and around the same depth as the existing water table. The decrease in groundwater levels has the potential to oxidise the sulfide minerals present in these soils, and leach acidity, metals and nutrients into groundwater because the drawdown exposes previously submerged potential acid sulfate soils. This may cause acidification of groundwater potentially affecting the protected beneficial uses (refer to Chapter 5 *Modelling the water environment* for definition of beneficial uses).

The risk levels associated with groundwater drawdown and mounding resulting in activation of potential acid sulfate soils are different for each project area and have been addressed separately below.

Edithvale

At Edithvale, actual acid sulfate soils have been identified in the project area at depths of five and 10 meters below ground surface. These depths are below the existing groundwater level, so the risk of mobilisation of existing acidity due to mounding of groundwater on the up gradient side of the trench as a result of an increase of groundwater level is negligible.

The majority of the potential acid sulfate soils have been identified below sea level as shown on Figure 7.6. The water table would not drop below sea level at coastal locations and, as such, any potential acid sulfate soils located below sea level can only be activated through excavation and not from lowered groundwater levels.

The initial assessment found a moderate risk of activation of acid sulfate soils and acidification of groundwater at Edithvale.

To reduce the risks associated with groundwater drawdown at Edithvale an engineering solution was developed to limit the magnitude and extent of mounding and drawdown. The engineering solution is described in Chapter 2 *Rationale and project descriptions*.

The performance of the engineering solution was modelled (see Appendix H of EES Technical Report A *Groundwater*) to demonstrate that it would be able to achieve the performance outcomes specified in EPR_GW2, which includes a requirement that the projects would not result in degradation to groundwater quality that would preclude beneficial uses of groundwater.

The groundwater model developed for the EES was used to model the impact on groundwater at Edithvale following construction of the trench and the proposed engineering solution to manage groundwater flow. The maximum drawdown was 0.2 metres within 50 metres of the rail trench. This level of groundwater drawdown is well within the range of natural variation and is considered to result in a negligible risk of impact.

It is considered very unlikely that potential acid sulfate soil would be activated from groundwater being lowered. Figure 7.6 shows the results of the implementation of the engineering solution in relation to the location of potential acid sulfate soils. Additionally, it is possible that the potential acid sulfate soils in these areas have already been activated due to natural variations in groundwater levels already exposing them to oxygen. This is supported by the groundwater results for the shallow aquifer which shows presence of existing acidity, however, there was sufficient capacity measured in the groundwater to neutralise this acidity.

A Groundwater Management and Monitoring Plan (EPR reference GW3) would be implemented to monitor groundwater quality and levels. The monitoring program would enable monitoring of the project to ensure compliance with the relevant EPRs, in particular EPR_GW2. Although activation of acid sulfate soils is considered unlikely to occur, monitoring would also enable early detection of impacts as a result of potential acid sulfate soil activation and groundwater acidification. A Groundwater Quality Mitigation Plan would be implemented if the groundwater monitoring identifies groundwater acidification is occurring (EPR reference CL5). The Groundwater Quality Mitigation Plan would include measures to maintain or manage the beneficial use of groundwater affected by acidification.

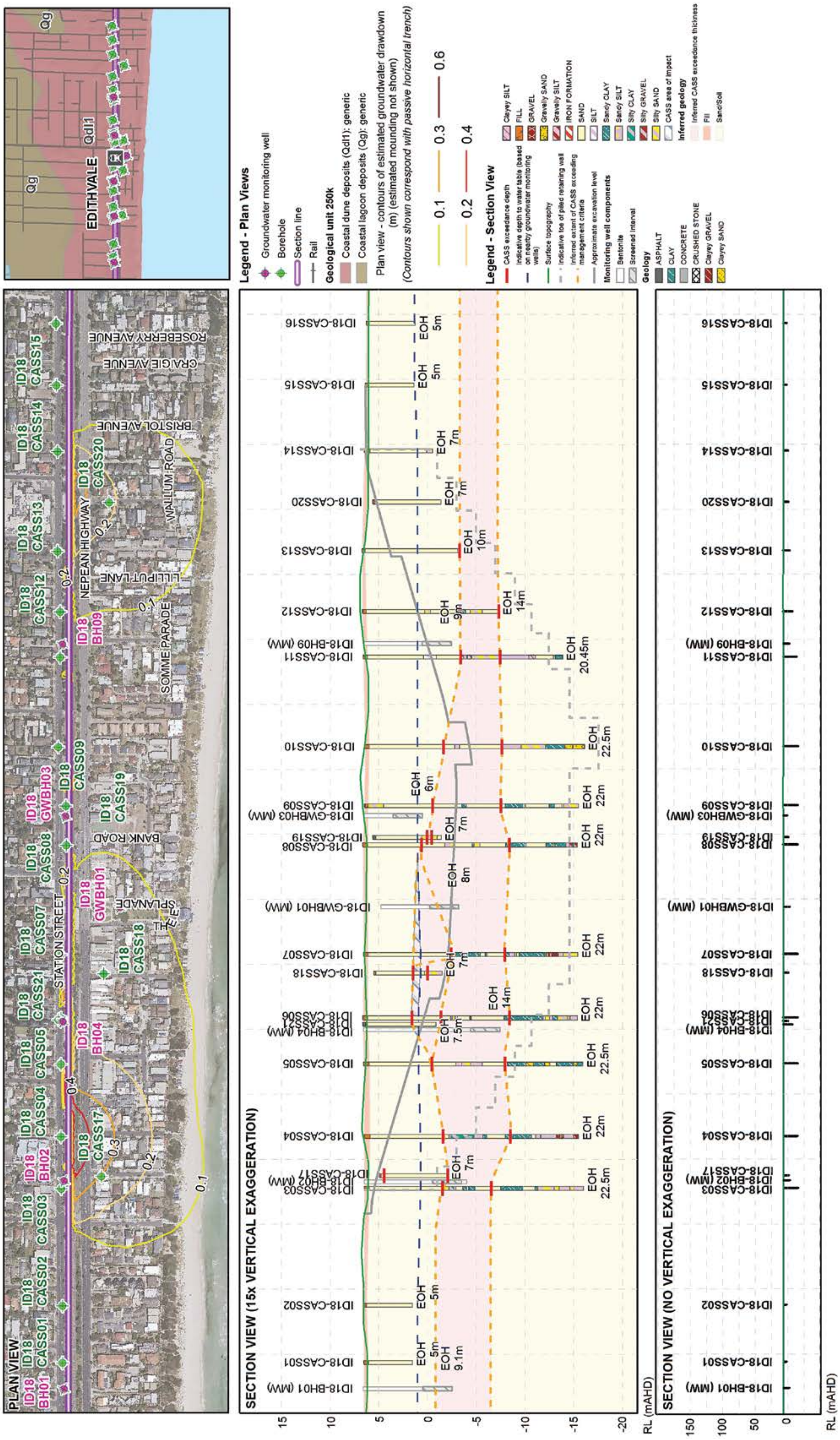
Bonbeach

At Bonbeach, the groundwater modelling predicted that groundwater levels would fall by a maximum of 0.7 metres adjacent to the rail trench on the western side. The majority of potential acid sulfate soils have been identified below sea level except in two limited locations, shown on Figure 7.7. These areas are located within the zone of predicted groundwater change and would be impacted by the predicted groundwater drawdown. It is considered almost certain that any potential acid sulfate soil would be exposed to oxygen as a result of decreasing groundwater levels in these areas, however, the extent of potential acid sulfate soil is confined to two relatively small locations. It is also possible that the potential acid sulfate soils in these areas have already been activated due to natural variations in groundwater levels already exposing them to oxygen. This is supported by the groundwater results for the shallow aquifer which shows the presence of existing acidity, however there was sufficient capacity measured in the groundwater to neutralise this acidity. Subsequently, the risk of the activated acid sulfate soil, as a result of the pile wall installation and associated groundwater drawdown, having an impact on beneficial uses was assessed as having a minor risk level and would be managed in accordance with EPR_GW2.

The likely effectiveness of the engineering solution described in Chapter 2 *Rationale and project descriptions* has been assessed using the groundwater model prepared for the EES. The solution has been found to be ineffective at Bonbeach due to the difference in the direction of groundwater flow in this location. The engineering solution would therefore not be an effective additional mitigation for this potential impact. A detailed assessment is provided in Appendix H of EES Technical Report A *Groundwater*.

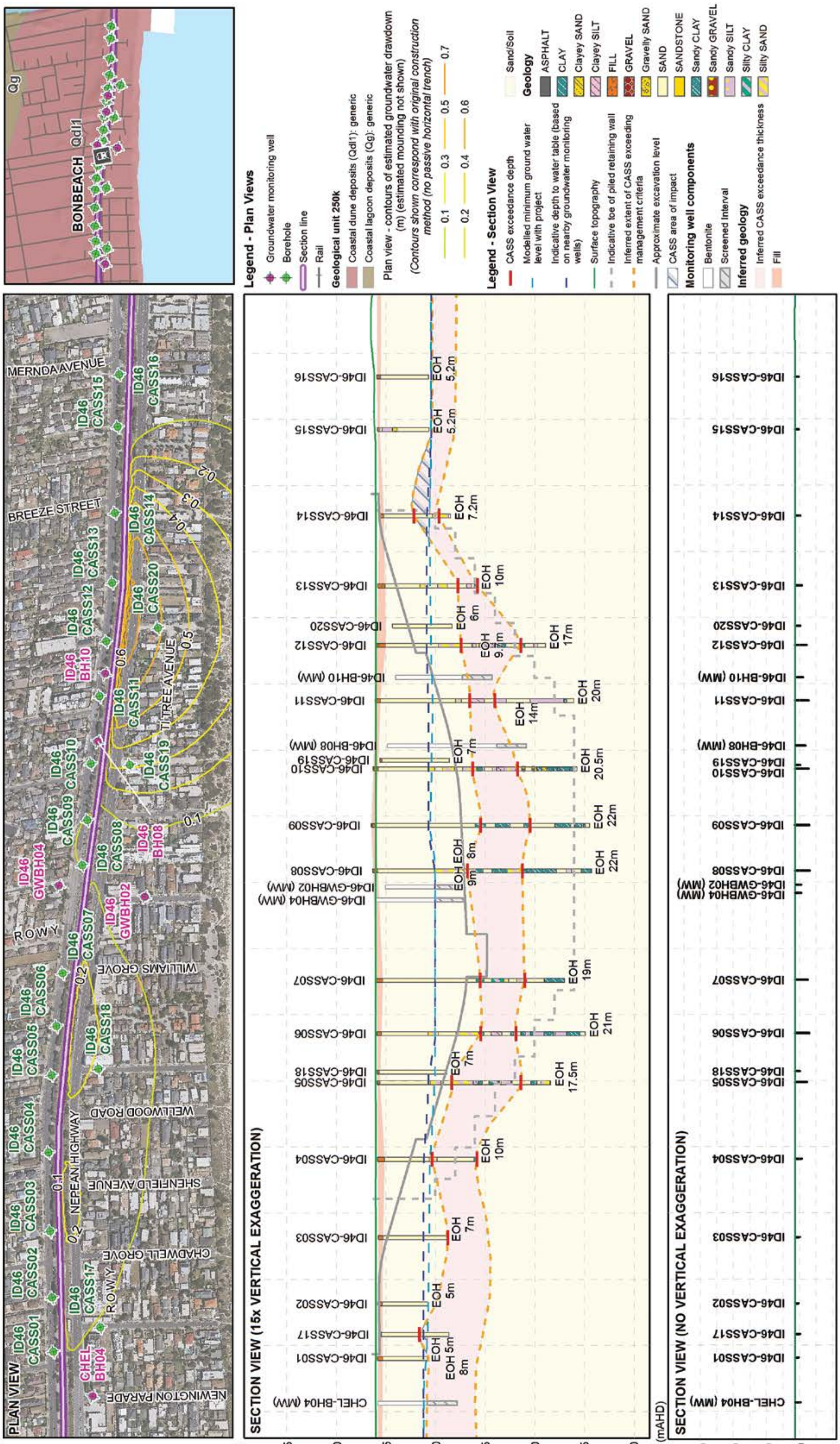
A Groundwater Management and Monitoring Plan (EPR reference GW3) would be implemented to monitor groundwater quality and levels. The monitoring program would enable monitoring of the performance of the project against the modelled predictions and would also provide further confidence in the model results. This would enable early detection of impacts by potential acid sulfate soil activation and groundwater acidification. A Groundwater Quality Mitigation Plan would be implemented if the groundwater monitoring identifies groundwater acidification is occurring (EPR reference CL5). The Groundwater Quality Mitigation Plan would include measures to maintain or manage the beneficial use of groundwater affected by acidification.

Figure 7.6 Geotechnical borehole locations and indicative depth to CASS (Edithvale)



A larger format version of this figure is provided in Attachment VI Map book.

Figure 7.7 Geotechnical borehole locations and indicative depth to CASS (Bonbeach)



A larger format version of this figure is provided in Attachment VI Map book.

Movement of contamination plumes from groundwater changes (risk GW62 and GW69)

The construction of the pile walls on both sides of the trench at each site has the potential to change hydrogeological conditions. Groundwater modelling included in EES Technical Report A *Groundwater* shows that the effect of the pile walls on groundwater would be:

- levels would rise (mounding) to the east of the rail trench
- levels would fall (drawdown) to the west of the rail trench
- groundwater flow would be diverted to the north or south by the rail trench.

Drawdown and mounding would commence within months of installing the pile walls and would continue over the life of the trench.

Depending on the amount of groundwater level change and diversion of groundwater, it could cause the migration of any existing contaminant plumes, associated with potential sources of contamination, into previously non-impacted areas of groundwater. Migration of contaminant plumes could result in adverse changes to groundwater chemistry (contamination) precluding some or all of the beneficial uses of groundwater (as defined in the *State Environment Protection Policy – Groundwaters of Victoria*) and/or land (as defined in the *State Environment Protection Policy – Prevention and Management of Contamination of Land*).

Edithvale

As discussed in Chapter 5 *Modelling the water environment*, through the risk and impact assessment process, a need to manage groundwater at Edithvale was identified to reduce the potential changes to groundwater levels caused by the pile walls and associated impacts.

To manage this risk associated with the pile walls, a potential engineering solution which would improve the flow of groundwater around the pile walls compared to the predictions obtained from the initial assessment was developed and modelled for the Edithvale level crossing removal project. In considering a potential engineering solution, performance outcomes were developed to provide minimum requirements for development of technical designs (EPR reference GW2). Ultimately, the solution would need to ensure that the difference in groundwater levels on either side of the trench would not result in:

- groundwater mounding that increases water logging at ground level
- groundwater drawdown that could cause ground subsidence and adverse impact to subsurface structures
- degradation to groundwater quality that would preclude beneficial use of groundwater
- changes to groundwater that would have significant impacts on groundwater dependent ecosystems.

Refer to Chapter 5 *Modelling the water environment* for further details.

The risk of contaminant migration impacting beneficial uses of groundwater and/or land (following the installation of the pile walls) was initially assessed as having a moderate risk level. This is because the initial groundwater modelling predicted that groundwater flow paths would be altered as a result of the pile wall installation and that groundwater mounding (increase in groundwater level) of up to 0.9 metres within 50 metres of the rail trench, and groundwater drawdown (decrease in groundwater level) of 1.4 metres within 50 metres of the rail trench would occur. Groundwater flowing toward the bay would also be diverted to the north or south by the pile wall.

The implementation of an engineering solution to reduce changes in groundwater levels at Edithvale consequently reduced the risks associated with the movement of contamination plumes from groundwater changes. The groundwater modelling of the engineering solution demonstrated a significant reduction in the potential for groundwater level changes compared to the initial assessment. The maximum drawdown after the introduction of the engineering solution was 0.2 metres within 50 metres of the rail trench and the maximum mounding was 0.2 metres within 50 metres of the rail trench. This would reduce both the amount of groundwater level change and the extent of the area affected by groundwater level changes.

This would result in a reduction in the number of potential sources of contamination within the reduced area of groundwater change to two services stations and the Edithvale fire station. The combination of a reduction of the extent of drawdown and mounding and a reduction in the number of potential sources of contamination within the area of impact results in a reduction in the risk of contaminant migration impacting some or all of the beneficial uses of groundwater from moderate to minor. Furthermore, the management, monitoring and mitigation regime (EPR reference GW3 and CL5) would provide early detection of impacts and the application of appropriate mitigation measures. Such an approach is commensurate with a minor risk level.

The groundwater management plan for the construction period would include a targeted baseline groundwater assessment, taking into account the site history (EPR reference CL4). This can be used to identify if groundwater contamination plumes exist within the area of groundwater level change and the extent of the plumes (if present). After installation of the pile walls, implementation of a Groundwater Management and Monitoring Plan (EPR reference GW3) would continue to enable the monitoring of groundwater quality and levels and would provide early detection of impacts (if identified). A Groundwater Quality Mitigation Plan would be implemented if the groundwater monitoring identifies that groundwater plume migration is occurring (EPR reference CL5). It would include measures to manage the beneficial uses of groundwater affected by contaminated groundwater plume migration or acidification attributable to the projects.

Bonbeach

The risk of contaminant migration impacting beneficial uses of groundwater and/or land as a result of drawdown, mounding and physical diversion of the groundwater at Bonbeach from the installation of the pile walls was assessed as a negligible risk level. This is because within the area of predicted groundwater change there are only three identified potential sources of contamination: a furniture manufacturer, a mower sales/service centre and a laundromat. All three identified potential sources of contamination are down hydraulic gradient of the pile wall and are located where groundwater drawdown is predicted to be 0.15 metres, which is within the range of natural groundwater level variability. In the unlikely event of contaminant plume migration occurring, the implementation of groundwater monitoring, management and mitigation plans (EPR references GW3 and CL5) would provide early detection of impacts and the application of appropriate mitigation measures.

7.7 Conclusion

The existing conditions assessment identified that the project was likely to interact with both acid sulfate soils (actual and potential) and contaminated soil and groundwater during construction. Acid sulfate soils naturally occur in the area and contaminated soil and groundwater is present as a result of historical land uses.

The spoil assessment estimated that 358,000 cubic metres of spoil (ex-situ) would be generated by the project across both areas. The majority of this (71 per cent at Edithvale and 73 per cent at Bonbeach) is likely to be classified as fill material. Waste acid sulfate soil (15 per cent) and Category C prescribed industrial waste (11 per cent) would also be produced by the projects. There is also expected to be some minor volumes of Category A and B prescribed industrial waste present.

A number of risks as a result of interactions with acid sulfate soils and contamination were identified and assessed. These risks were primarily associated with adverse impacts to human health and/or the environment. A risk assessment, taking into consideration the results of the existing conditions assessment and the application of risk minimisation and management measures resulted in all but two of the risks identified (discussed further below) being assessed as negligible. The reason most of the risks were found to be negligible is because the projects have been designed to include aspects that minimise the risks associated with acid sulfate soils and contamination, including the installation of the pile walls prior to the construction of the trench to minimise the potential for groundwater ingress into the trench and the rapid trench construction period that minimises the length of time soil would be exposed. Additionally, the development and application of management plans to specifically address spoil management, acid sulfate soils and construction techniques in accordance with current policies and guidelines, would further minimise the potential for adverse impacts as a result of the projects. These are further outlined below.

The two remaining risks that were assessed as minor were associated with changes to groundwater levels as a result of the installation of the trench and were applicable for construction (from when the pile walls were installed) and through operation:

- activation of acid sulfate soils as a result of groundwater level drawdown
- movement of contamination plumes as a result of groundwater mounding and drawdown and the presence of the trench.

Impacts associated with these risks are more pronounced at Edithvale than at Bonbeach. Implementation of a potential engineering solution which would reduce groundwater level changes across the trench at Edithvale, resulted in a decrease in the risk levels to negligible for acid sulfate soil activation, and minor for the movement of contaminant plumes.

The risks caused by groundwater level changes at Bonbeach were considered sufficiently low such that alteration to the modelled design would not be required to achieve the performance outcomes listed in EPR_GW2.

The lesser impact predicted at Bonbeach is primarily due to the difference in local groundwater flow direction, which is perpendicular to the pile wall at the Edithvale site, resulting in greater impedance of groundwater throughflow. At the Bonbeach site, groundwater flows towards the south, towards Patterson River. At areas where the flow line is parallel to the pile wall, less impedance on groundwater throughflow is predicted.

The locations of the pile walls relative to the location of the local groundwater flow divide at Bonbeach also act to reduce impacts predicted at Bonbeach. At Bonbeach, the groundwater flow divide is inferred to approximately coincide with the rail trench, resulting in limited opportunity for the pile walls to interrupt lateral flow of groundwater across the rail trench.

Furthermore, the impact of these risks at Bonbeach was assessed as minor for acid sulfate soil activation (because there are only limited, small areas of acid sulfate soils that could become activated), and negligible for the movement of contaminant plumes without any additional management of groundwater (because the identified potential sources of contamination fall within an area of drawdown that falls within the range of natural variability).

The impacts associated with these risks would be managed in accordance with the established legislative framework for acid sulfate soils and contamination and through the implementation of EPRs requiring the following management and mitigation measures:

- preparation of a Spoil Management Plan which would include:
  - completion of a sampling program to classify the nature and extent of contamination levels prior to excavation
  - management measures for the storage, handling and transport of spoil to protect human health and the environment
  - identification of suitable disposal facilities for material excavated
- preparation of an Acid Sulfate Soil Management Plan which would include:
  - identification, on a site plan, of the location and extent of acid sulfate soils likely to be encountered
  - identification of suitable sites for the management or disposal of acid sulfate soils
- development of a CEMP to reduce adverse impacts during construction such as designating areas for vehicle refuelling and washing, the provision of spill kits to contain any spills that may occur and providing litter bins to contain waste on site
- development of measures to manage acidic and/or contaminated groundwater including:
  - completing a baseline groundwater assessment prior to commencing construction
  - implementing a system to manage and/or dispose of intercepted groundwater (if required) which may be a TWA with the relevant utility authority or other measures in accordance with relevant guidelines and legislation (if a TWA is not granted)
  - undertaking groundwater monitoring during construction.

Management of the risks associated with changes to groundwater levels after the installations of the pile walls would be through the implementation of EPRs requiring the following:

- the trenches at Edithvale and Bonbeach must be designed to ensure that groundwater level changes (as a result of the projects) do not result in degradation to groundwater quality that would preclude beneficial use of groundwater from contaminants or acid sulfate soils (EPR references GW1 and GW2).
- development and implementation of a Groundwater Management and Monitoring Plan (EPR reference GW3)
- development of trigger levels for changes in groundwater level and / or quality that require mitigation plans to be implemented (EPR reference CL5).

9 ENVIRONMENTAL MANAGEMENT FRAMEWORK

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9.1 Scoping Requirements

This chapter responds to Section 3.5 of the Scoping Requirements which requires an Environmental Management Framework (EMF) to be prepared for the projects.

The Scoping Requirements state:

The EMF should describe the baseline environmental conditions to allow evaluation of the residual environmental effects of the project, as well as the efficacy of applied environmental management and contingency measures. The framework should include:

- *an environmental management system, with organisational responsibilities, accountabilities and governance arrangements;*
- *an environmental risk register that is maintained during project implementation; and*
- *environmental management measures proposed in the EES to address specific issues, including commitments to mitigate adverse effects and enhance environmental outcomes.*

The EMF should outline the environmental management plans for construction and operation phases of the project as well as the process and timing for development of these plans. The entity responsible for approval of the plans should be identified.

An important aspect of the EMF is community consultation, stakeholder engagement and communications during the construction and operation of the project. As the project proceeds it will largely be the EMF that outlines opportunities for local stakeholders to engage with LXRA to seek responses to issues that might arise during construction or operation. To this end the EMF will set out procedures for:

- *complaints recording and resolution*
- *auditing and reporting of performance including compliance with relevant statutory conditions and standards; and*
- *review of the effectiveness of the environmental management framework for continuous improvement.*

Project environmental performance requirements that define project-wide environmental outcomes to be achieved should be clearly described in the EMF. The proposed objectives, indicators and monitoring requirements to be described, are:

- *biodiversity values, particularly with respect to the Edithvale-Seaford Wetlands and its ecological character;*
- *groundwater levels, behaviour, quality and protected beneficial uses, particularly with respect to their potential for change in the context of climate change and the potential impacts on the Edithvale-Seaford Wetland;*
- *surface water catchments, drainage and behaviour, and beneficial uses;*
- *solid and liquid waste, including recycling and handling of potentially hazardous or contaminated waste, potential acid sulphate soils (PASS) and other excavated spoil;*
- *social outcomes and community engagement;*
- *noise, vibration, and emissions to air;*
- *energy and greenhouse gas emissions;*
- *Aboriginal and historic cultural heritage values;*
- *transport management;*
- *traffic during construction; and*
- *site reinstatement.*

9.2 Statutory context

This chapter presents the EMF for the Edithvale and Bonbeach level crossing removal projects.

The design and construction of the projects would be authorised and regulated by Incorporated Documents that would be incorporated into the Kingston Planning Scheme and by the approval of the controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Incorporated Documents would set out the requirements for an EMF for the projects.

The Incorporated Documents requires the EMF to be approved by the Minister for Planning.

The EMF would be approved by the Minister for Planning prior to the commencement of buildings and works (other than preparatory works) under the Incorporated Documents. The design and construction of the projects would be required to be carried out in accordance with the approved EMF.

9.3 Purpose of the EMF

This EMF provides a transparent and integrated governance framework to manage the environmental effects of the Edithvale and Bonbeach level crossing removal projects identified in this EES. It responds to Section 3.5 of the Scoping Requirements issued for the EES, as well as the need to ensure a high level of rigour within the environmental management of both projects.

The objectives of the EMF are to:

- establish a framework to ensure compliance with statutory requirements and minimise environmental risks
- set out the environmental outcomes to be achieved during design and construction and encourage innovation to achieve them
- ensure accountabilities are identified for managing and monitoring environmental effects and hazards associated with the design and construction phases of the projects.

The EMF outlines clear accountabilities for the delivery and monitoring of the implementation of the projects and includes a set of Environmental Performance Requirements (EPRs). As outlined in Chapter 4 *Assessment framework,* the EPRs determine the environmental outcomes that the design and construction of the Edithvale and Bonbeach projects must achieve. The EPRs have been developed through the preparation of the EES. The performance-based approach that underpins the EPRs provides for sufficient flexibility to encourage innovation by the contractor engaged to determine how the standards contained in the EPRs would be achieved.

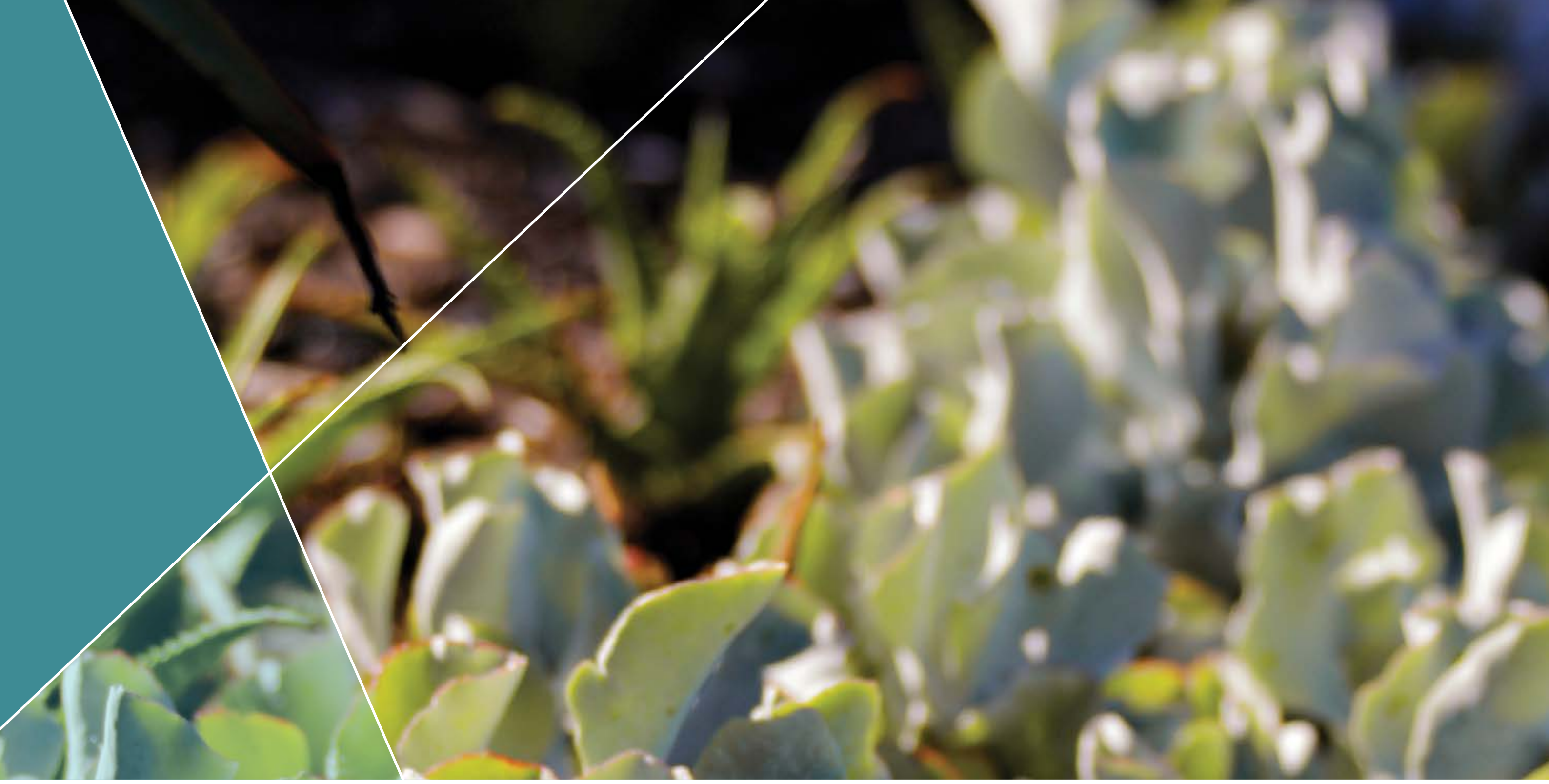
The EMF outlines clear accountabilities for the delivery and monitoring of the EPRs so that the environmental effects of the projects would be managed.

The EMF requires the contractor constructing the projects to implement an Environmental Management System (EMS) certified to AS/NZS ISO 14001: 2015 *Environmental management systems – Requirements with guidance for use* and to comply with relevant legislation, policy and guidelines, and LXRA's Environmental Management Framework.

The purpose of the requirement for an EMS is to ensure that works are planned and performed so that the adverse effects on the environment are either avoided, minimised or managed, and are carried out in accordance with the EPRs. This EMF requires the contractor to specifically apply its EMS, and modify if required, for the delivery of works for the projects.

The EMF provides a structured approach for monitoring the implementation of the Construction Environment Management Plan (CEMP) and other plans required to comply with the EPRs, the Incorporated Documents and any statutory approvals.

The contractor's compliance with the EMF, CEMP and other management documents would then be audited throughout the project. Refer to Sections 9.8 and 9.9 of this EMF for a description of the management plans and requirements for ongoing monitoring of their implementation.



9.4 Projects overview and description

Following completion of the EES process, the EMF would be updated to include a project overview and description, consistent with that in Chapter 2 *Rationale and project descriptions* and the Incorporated Documents.

9.5 Contract structure

This section outlines LXRA's contract structure and procurement strategy for the projects. The governance framework established by these contracts would, together with the statutory obligations and requirements of the Incorporated Documents, ensure implementation of this EMF.

The projects would be delivered through an Alliance contract model. Alliance contracting is a form of relationship contracting where a construction company, engineering designers, architects and other specialists, partner with the Victorian Government (represented by LXRA) to prepare the final detailed design and construct the projects. LXRA staff would work within the Alliance team and LXRA would also provide corporate oversight of the Alliance's performance.

The procurement process would include the requirement for bidders to demonstrate certification to AS/NZS ISO 14001 and set out their environmental management approach. This would enable the bidders to demonstrate their approach to achieving compliance with the EMF. LXRA would review and assess this information against the requirements of the EMF.

The contractor would be appointed under a Program Alliance Agreement (PAA). LXRA would administer the PAA on behalf of the Victorian Government. The PAA would detail the contractor's obligations for delivery of the works.

Following contract award and prior to construction commencing, the Alliance would be required to apply its existing EMS to the specific activities for construction of the projects and develop and implement a CEMP to meet the requirements of this EMF.

The CEMP would describe in detail how the Alliance would meet the EPRs and approval conditions and identify, manage and mitigate environmental risks arising during design and construction. Specific requirements for the Alliance documentation are outlined in Section 9.8.

9.6 Governance framework

The projects would be delivered within the context of LXRA's Environmental Management Framework (LXRA-EMF), as well as the statutory context and contract structure. The LXRA-EMF addresses the planning, environmental and heritage aspects of all projects and packages being delivered by LXRA. It applies across the whole project lifecycle from assessment and approvals planning through to implementation and delivery, and completion.

Its key objectives are to:

- minimise project delivery, approvals, environmental and reputational risks
- increase certainty that key environmental risks are identified and meaningfully considered early in project planning and throughout project delivery
- set out the expected performance-based outcomes during design and construction and encourage innovation by delivery partners to achieve them
- ensure environmental effects and hazards are appropriately managed in a consistent manner across the Level Crossings Removal Program and good environmental outcomes are achieved.

Delivery partners (i.e. contractors) and LXRA itself are required to implement and comply with the LXRA-EMF which sets out standards, processes and expectations for:

- roles and responsibilities
- environmental management plans and documentation
- contingency measures
- evaluating environmental performance including monitoring, auditing and reporting.

For implementation and delivery, the LXRA-EMF requirements are principally delivered through the PAA. The PAA would include a requirement to implement and comply with the EMF and the EPRs.

The PAA would:

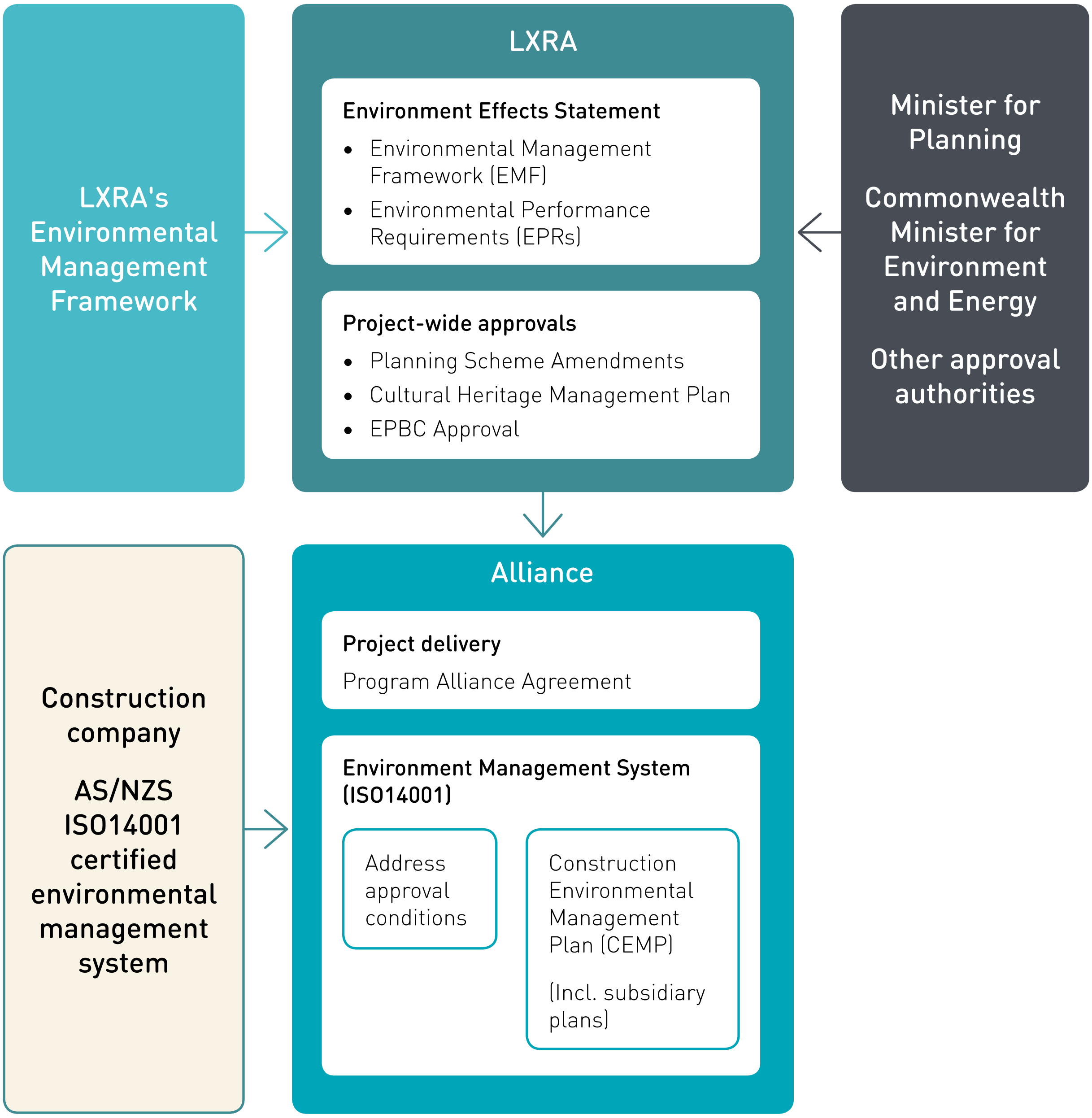
- require the construction company engaged to deliver the project to be certified to the international environmental management systems standard AS/NZS ISO 14001
- require the Alliance to conduct its activities under the construction company's certified environmental management system and the appropriate elements of the LXRA-EMF
- specify the obligations on all Alliance partners for project design and delivery, specifically requiring the Alliance to comply with this EMF (including the EPRs), as well as legislation and conditions associated with project approvals
- prepare and implement project-specific environmental management documentation as set out within this EMF and as appropriate for the design and construction of the projects.

The Alliance would be responsible for preparing the CEMP and other environmental management documentation, which is subject to the approval requirements set out in Table 9.4. This documentation would govern the management of all project activities to ensure that all applicable requirements are met. It would apply to the projects regardless of the detailed designs and construction methods, and would establish how the environmental outcomes defined by the EPRs would be achieved.

The documentation itself, and the implementation of documented controls, would be subject to compliance audits, as required by the LXRA-EMF.

The governance framework is shown in Figure 9.1.

Figure 9.1 Governance framework


LXRA's Environmental Management Framework
LXRA
Environment Effects Statement
Environmental Management Framework (EMF)
Environmental Performance Requirements (EPRs)
Project-wide approvals
Planning Scheme Amendments
Cultural Heritage Management Plan
EPBC Approval
Minister for Planning
Commonwealth Minister for Environment and Energy
Other approval authorities
Construction company
AS/NZS ISO14001 certified environmental management system
Alliance
Project delivery
Program Alliance Agreement
Environment Management System (ISO14001)
Address approval conditions
Construction Environmental Management Plan (CEMP)
(Incl. subsidiary plans)

9.7 Roles and responsibilities

This section outlines the roles and responsibilities for environmental management in the design and construction of the projects. Roles and responsibilities for preparing and approving specific management plans required under the Incorporated Documents are set out in Section 9.8 of this EMF.

LXRA, on behalf of the Victorian Government, is responsible for delivering the projects in line with the requirements and objectives of the Level Crossings Removal Program and the Victorian Government.

LXRA is an Administrative Office in relation to the Department of Economic Development, Jobs, Transport (DEDJTR) (established under the Office of the Coordinator General), and is one of several agencies assisting the Victorian Government to achieve its integrated transport policy objectives. The LXRA Chief Executive Officer is accountable to the Minister for Public Transport, reporting to the Secretary of DEDJTR.

LXRA is responsible for overseeing and engaging contractors and consultants for all aspects of the projects. This includes site investigations, stakeholder engagement, preparing the EES that informs subsequent statutory approvals, obtaining key planning approvals and procurement, through to construction delivery and project commissioning. LXRA also supports the Secretary of DEDJTR in his capacity as project authority, charged with statutory responsibility for delivering the projects, under the *Major Transport Projects Facilitation Act 2009*.

Fulfilling the responsibilities and accountabilities across all elements of the EMF involves LXRA, the Alliance (including the construction contractor) and regulators. The contractor's responsibilities would be included as contractual requirements in the PAA. The Alliance would be responsible for activities conducted by its subcontractors.

At the completion of construction and project commissioning, the relevant rail infrastructure manager would become responsible for the ongoing operation and maintenance of the infrastructure delivered by the projects.

The key roles and responsibilities for environmental management are shown in Table 9.1.

Table 9.1 Organisational roles and responsibilities for environmental management

Topic	Key finding
Minister for Planning	• Approve the EMF and EPRs, and any amendments to these.
Commonwealth Minister for Environment and Energy	• Review conformance with the EPBC Approval.
Regulators and Agencies	• Administer and determine compliance with project approvals.
LXRA	• Obtain applicable project-wide statutory approvals, as required, generally including the Planning Scheme Amendments and Cultural Heritage Management Plan, where it is appropriate for LXRA to obtain such approvals outside of the Alliance. • Establish the EMF for approval by the Minister for Planning as required by the Incorporated Documents. • Implement its responsibilities under the EMF. • Establish the Urban Design Guidelines for the projects. • Monitor compliance with the EPRs. • As an Alliance member, develop and submit the required plans to comply with the requirements of the Incorporated Documents and this EMF. • Review and approve contract documentation required by the PAA for both projects in accordance with this EMF, including the CEMP and associated sub-plans. • Prior to and during construction, verify that the Alliance has complied with the relevant EPRs and other legal requirements relevant to environmental management. • Ensure audits are conducted of the Alliance's environmental performance, consistent with the requirements of the LXRA-EMF. • Review the Alliance's performance against the approved EPRs and take corrective action as necessary.
Rail infrastructure manager	• Operate and maintain the rail infrastructure.

Topic	Key finding
Alliance	• Comply with its responsibilities under this EMF (including the EPRs) and legislative and approval requirements (i.e. conditions associated with project approvals). • Obtain any additional permits, consents or approvals required to design and construct the projects from regulatory authorities (other than the approvals that would be obtained by or jointly with LXRA). The full suite of approval requirements are set out in Attachment I *Legislation and Policy Report*. • Apply the Alliance construction partner's EMS to the specific activities for the projects, in accordance with AS/NZS ISO 14001: 2015. • Prepare a CEMP and other plans set out in this EMF, including any specific plans required by the Incorporated Documents and the EPRs. • Provide adequate resources to establish, implement, maintain and improve the EMS, CEMP, and other plans as required by statutory approvals, EPRs and PAA. • Implement and maintain compliance with the EPRs applicable to the Alliance. • Undertake environmental audits to confirm compliance with the EMF, EPRs and plans required by the Incorporated Documents. • Prior to and during construction, ensure that the Alliance and its subcontractors have complied with the relevant EPRs, CEMP and other plans as required by the Incorporated Documents, EPRs or project contracts. • Review subcontractors' performance against the EPRs and CEMP, and take corrective action as necessary.

9.8 Environmental management plans and documentation

This section provides an overview of how the environmental management systems and plans required under this EMF would be documented. It describes the process for preparing the systems and plans, who is responsible for preparing and approving them, and when they would be prepared and approved.

9.8.1 Overview

The EMF would be implemented through an environmental management system, a CEMP and other plans that would be documented and prepared by LXRA (on behalf of the Victorian Government) and by the Alliance (including the construction contractor). These plans would also be designed to implement and achieve compliance with the LXRA-EMF and with relevant legislation and the other requirements of the Incorporated Documents (refer to Figure 9.1).

The LXRA-EMF (aligned to AS/NZS ISO 14001: 2015 *Environmental management systems –requirements with guidance for use*) sets out environmental management responsibilities and compliance for all parties, including the contractor.

Additional project-specific strategies and plans include the Cultural Heritage Management Plan (CHMP) and the Urban Design Guidelines (UDGs).

At the state level, LXRA would be accountable for implementing the EPRs and compliance with statutory decisions and approvals. LXRA would also be responsible for administering the PAA on behalf of the Victorian Government in accordance with its corporate procedures.

The Alliance would be required to apply the construction contractor's existing EMS to the specific activities for construction of the projects. The contractor must have an EMS that is certified to AS/NZS ISO 14001: 2015. The purpose of the EMS would be to establish a system whereby environmental risks and impacts are managed, and ensure there is a process for identifying opportunities of continual improvement across the projects.

The Alliance would prepare plans to comply with the approval requirements of the planning controls applied under the Incorporated Documents. The Alliance would also be required to prepare a CEMP and other plans required by the EPRs for the construction phase.

For the operations phase, any ongoing responsibility for any residual monitoring or maintenance requirements relevant to environmental management would be in accordance with pre-existing roles and responsibilities and management systems implemented by the rail infrastructure manager.

LXRA and the contractors would develop and implement environmental management plans and programs generally in accordance with the processes in Section 9.8.3, and the approval and timing requirements in Section 9.8.4.

There are a number of levels of plans required for delivery of the projects as summarised in Table 9.2.

A detailed description of the key documentation elements of the EMF is provided in Section 9.8.3.

9.8.2 Managing groundwater impacts

This EMF provides a tiered approach to managing impacts that result from potential changes to groundwater quality and levels, as a result of the projects.

The tiered approach recognises that changes to groundwater quality and levels are likely to have different impacts on different aspects of the environment.

To manage this, an overarching Groundwater Management and Monitoring Plan would be prepared prior to commencement of construction of relevant works. The Groundwater Management and Monitoring Plan would include specific triggers, based on observed changes to groundwater level and quality, for specific mitigation measures to be implemented.

Specific mitigation plans would be prepared prior to handover of relevant works to the rail infrastructure manager to manage specific aspects of the environment, in accordance with the EPRs for those aspects. The proposal for a number of mitigation plans recognises that ecological impacts are different from groundwater quality impacts and that the stakeholders concerned have different interests. These plans would be prepared in consultation with the agencies with jurisdiction over those aspects of the environment. While the environmental assessment of the projects indicates that there is a low potential for any further mitigations to be required, LXRA has adopted a conservative approach in proposing that these contingency plans be prepared.

The tiered approach is set out in Table 9.2.

Table 9.2 Organisational roles and responsibilities for environmental management

Description	Plans
1. Strategic framework Plans that set the strategic direction and governance of the projects.	• Environmental Management Framework with EPRs. • Urban Design Guidelines.
2. Management of broad impacts Plans to guide specific programs or works to manage potential impacts on the environment or community broadly.	• Construction Environmental Management Plan. • Community and Stakeholder Engagement Management Plan. • Construction Noise and Vibration Management Plan. • Cultural Heritage Management Plan.
3. Management of groundwater impacts Plan that sets out the requirements for monitoring groundwater level and quality, and sets of criteria for when Groundwater Mitigation Plans should be implemented.	• Groundwater Management and Monitoring Plan (EPR_GW3).
4. Mitigation plans Specific plans to be implemented if the criteria for changes to groundwater level and quality are met. Each plan deals with a specific aspect of the environment.	• Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (Foreshore Native Vegetation) (EPR_FF7). • Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (Edithvale-Seaford Wetlands) (EPR_FF8). • Groundwater Quality Plan (EPR_CL5).
5. Technical plans Specific plans required by the EMF and EPRs.	• Transport Management Plan. • All other plans required by EPRs. These plans would describe the Alliance's methods of implementing the EMF and other regulatory requirements rather than the strategic direction and governing requirements for the projects, or matters of less broad community impact.

9.8.3 Process for developing key plans

The key environmental management documents and the process for developing plans are outlined in Table 9.3.

Table 9.3 Key environmental management documentation

Documentation	Description
State of Victoria (LXRA)	
Environmental Management Framework	This document provides the governance framework to manage environmental aspects as identified through the EES process, including the Minister for Planning's Assessment for the projects.
Environmental Performance Requirements (part of the EMF)	EPRs (Table 9.5) have been developed through the EES and associated consultation processes, and to inform the Minister for Planning's assessment of the EES, the requirements of the Incorporated Documents and the EPBC Approval. EPRs define the project-wide environmental outcomes that must be achieved during design and construction and operation of the projects (regardless of the solutions adopted).
Groundwater Management and Monitoring Plan	Plan that sets out the requirements for monitoring groundwater level and quality.
Monitoring and mitigation plans	Plans setting out specific mitigation measures if criteria for impact set out in the Groundwater Management and Monitoring Plan are met.
Other decisions and approvals that LXRA is responsible for obtaining	• Approval of two planning scheme amendments to implement specific planning controls for the projects, including an Incorporated Document for each project. • EPBC Act decision (controlled action) under the EPBC Act. • Cultural Heritage Management Plan.
Urban Design Guidelines	The project-specific Urban Design Guidelines provide urban design guidance relating to the design and implementation of the projects.
Alliance (including construction contractor)	
Environmental Management System	Consistent with EPR_EMF1, the contractor's EMS will be required to be certified to AS/NZS ISO 14001: 2015 Environmental management systems – requirements with guidance for use. The contractor's existing EMS will be specifically applied to the projects.

Documentation	Description
Alliance (including construction contractor)	
Construction Environmental Management Plan	Consistent with EPR_EMF2, the Alliance (including the construction contractor) must prepare a CEMP, in accordance with applicable EPRs. The CEMP would reflect the requirements of the EMF and EPA Victoria Publication No. 480 *Environmental Guidelines for Major Construction Sites*. The CEMP would be developed to take into account: • each construction site's environmental features • the nature of the works to be undertaken • potential environmental impacts as identified in the EES and activity-specific environmental risks • permits and/or approvals and related approval requirements • the findings of environmental investigations undertaken by or on behalf of LXRA • the findings of any environmental investigations undertaken by the Alliance. The Alliance may choose to develop one CEMP for its entire package of works or individual CEMPs for each component of the works. Similarly, the Alliance may choose to address all of the above environmental impacts within one CEMP or a series of sub-plans for each environmental value. The exception to this is where an EPR requires the development of a specific management plan. A CEMP will be developed once the detailed design and refined construction methodology is prepared by the Alliance. A CEMP will be prepared in consultation with agencies relevant to each plan including Kingston City Council, Heritage Victoria, VicRoads, Melbourne Water, Public Transport Victoria and EPA Victoria and key affected stakeholders, as required under the Incorporated Document and any relevant EPR. The CEMP would include a mechanism to ensure comments and complaints from the community are considered and responded to. Note – not all plans required by the EPRs or the Incorporated Document will be sub-plans to the CEMP. The structure of plans and sub-plans will be determined by the Alliance to allow for an integrated approach to addressing and managing impacts across the various plans.
Community and Stakeholder Engagement Management Plan	Sets out the principles and framework for community and stakeholder engagement for the projects and addresses the requirements set out in EPR_SC1.
Transport Management Plan/s (TMP)	The TMP(s) will document how the contractor will minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction and address the requirements of EPR_T1. It addresses all modes of active and passive transport. A TMP will be developed once the detailed design and refined construction methodology is prepared. A TMP will be prepared in consultation with agencies relevant to the plan including relevant Kingston City Council, VicRoads, and affected stakeholders as relevant, as required under the Incorporated Document and any relevant EPR.

Documentation	Description
Alliance (including construction contractor)	
Construction Noise and Vibration Management Plan (CNVMP)	Consistent with EPR_NV2, the CNVMP must comply with and address Noise and Vibration EPRs, be informed by the modelling undertaken by the acoustic and vibration consultant and must include (but not be limited to): • identification of sensitive receivers along the alignment. • details of construction activities and an indicative schedule for construction works, including the identification of key noise and/or vibration generating construction activities (based on representative construction scenarios, including at ancillary facilities) that have the potential to generate noise and/or vibration impacts on surrounding sensitive receivers.
Controlled environmental management documentation subsidiary to the CEMP	Includes procedures, forms, registers and work method statements (describing work activities, approvals required and risk assessment and control measures).
Records and checklists	• Monitoring and inspection records. • Checklists (e.g. environmental site inspection checklist). • Records (e.g. training/competency records, waste transport and disposal certificates).

9.8.4 Approvals and change management

An outline of the review and approval requirements for the key construction phase environmental management documents of the EMF is provided in Table 9.4. All plans and documentation would be prepared and approved prior to the relevant works commencing.

Revisions to LXRA and Alliance documentation may be required because of changes in activities and work practices, results of monitoring, changes to legislation, risks, or as a result of findings from internal or external audits, incidents or complaints. The Alliance's EMS and CEMP (and other plans as required by the EPRs) would be controlled documents and would be developed, approved, implemented and revised in accordance with Table 9.4.

Table 9.4 Key construction phase environmental management documentation approval requirements

Document	Version	Minister for Planning	State of Victoria (LXRA)	Alliance
Environmental Management Framework with EPRs	• Initial EMF and EPRs. • A revision to the EMF.	Approve	Prepare	Comply with
Contractor's Environmental Management System	• Current version.	–	Review and evaluate	Provide and implement
Construction Environment Management Plan (CEMP)	• Initial CEMP. • A revision to the CEMP.	–	Approve	Provide and implement
Implementation of approved CEMP	• CEMP is to be implemented prior to carrying out substantial works and audited for compliance.	–	Review and evaluate	Provide and implement
Community and Stakeholder Engagement Management Plan (CSEMP)	• Initial CSEMP. • A revision to the CSEMP.	–	Approve	Provide and implement
Transport Management Plan(s)	• Initial TMP. • A revision to the TMP.	–	Approve	Provide and implement
Construction Noise and Vibration Management Plan	• Initial CNVMP. • A revision to the CNVMP.	–	Approve	Provide and implement

9.8.5 Contingency measures

The CEMP and plans required to comply with the Incorporated Document and EPRs will include appropriate contingency measures to address identified environmental, social and business risks. Contingency measures may be required to take effect in the event that monitoring or auditing (or any other means) identifies:

- unforeseen issues, or
- issues which are foreseeable but not expected to occur, or
- impacts which are expected but which prove greater than anticipated.

Contingency measures will be developed to comply with relevant regulations, standards and industry best practice guidelines.

Examples of potential contingency measures include protocols for management of groundwater (EPR reference GW3), managing the discovery of previously unidentified historical archaeological sites (EPR reference HH1) and a plan to address the containment, treatment and disposal of any fuel and chemical spills (EPR reference CL3). Contingency measures would also be a key part of the Cultural Heritage Management Plan for managing the discovery of previously unidentified Aboriginal heritage sites (EPR reference AH1).

9.8.6 Consultation

The Alliance is required to prepare a comprehensive CSEMP to sit alongside the CEMP that would set out the specific actions, requirements and processes to engage with the community and other stakeholders (such as local businesses and community and special interest groups). This is to ensure that they are kept informed of the projects' works as they progress. The CSEMP would reflect the requirements of LXRA's overarching Community and Stakeholder Engagement Plan and apply them to the site-specific context.

The CSEMP would include:

- procedures and requirements around notifications in advance of potentially impactful works (such as road closures or night-time noise)
- management of the closure of the railway, pedestrian and cyclist access and roads
- changes to cycling and/or pedestrian access.

Further information is presented in Chapter 12 *Community and stakeholder engagement.*

The Alliance would prepare a complaints management procedure as part of the CSEMP to ensure that complaints from the community regarding environmental performance during construction are logged, assigned a priority level, communicated to the relevant personnel within the Alliance to determine and implement the appropriate response, and that feedback to the complainant is provided and recorded. The complaints management procedure would also include timeframes for responding to complaints. The procedure would integrate with the CEMP so that it includes the necessary procedures for resolving, monitoring and recording environmental complaints.

9.9 Evaluating environmental performance

This section identifies the requirements for monitoring, reporting and auditing of compliance with the EMF, the EPRs, and the Incorporated Documents.

The PAA would specify compliance requirements for the Alliance (including the construction contractor) including monitoring, reporting to LXRA and relevant government agencies, and environmental auditing.

A summary of these compliance requirements is provided in this section. The CEMP would describe the Alliance's environmental compliance system, including:

- definitions of what constitutes a non-conformance
- requirement for a non-conformance tracking register
- timeframes and responsibilities for addressing non-conformances
- detailed procedures for monitoring, auditing and reporting, including the handling of complaints in relation to non-conformances with EPRs and the Incorporated Documents.

This section identifies the requirements for monitoring, reporting and auditing of compliance with this EMF.

9.9.1 Monitoring

The monitoring requirements would be specified in the CEMP and any other plans required to comply with the Incorporated Document, the EPRs, and relevant planning, environmental and heritage approvals.

The parameters to be monitored and the frequency of monitoring would reflect regulatory requirements and the level of potential risk to the environment. Monitoring would include periodic inspections of construction works areas.

The CEMP and on-the-ground construction activities would be reviewed regularly to verify that:

- the monitoring frequency is sufficient to identify whether any non-conformances with the EPRs, Incorporated Documents and legislation and regulations (including conditions of planning, environmental and heritage approvals) that have occurred
- the range of parameters being monitored is adequate (this is particularly relevant if an activity has led to an incident or complaint)
- changes to programmed construction activities are adequately covered by the monitoring programs
- any proposed modifications to monitoring programs will be submitted to LXRA for approval prior to being implemented. The Alliance would be responsible for the ongoing management of baseline and monitoring data to ensure the transparency and accountability of environmental management.

9.9.2 Reporting

Performance against the CEMP and other plans required to comply with the Incorporated Documents and EPRs would be reported to LXRA and relevant government agencies as appropriate. The CEMP would describe the reporting and external notification requirements, including what needs to be reported and to whom, and the timeframe for reporting.

Reporting and notification requirements would include, but not be limited to:

- monthly environmental performance reports submitted to LXRA. This report would include audit findings, monitoring results and incidents and non-compliances
- notification to LXRA and third-party regulators (as appropriate) in the event of environmental incidents, non-compliances, non-conformities or the discovery of previously unknown assets (i.e. heritage artefacts), in accordance with the CEMP and requirements of relevant legislation and approvals.

9.9.3 Peer review

Where required by the EPRs, the design and environmental management and monitoring approach to avoiding and minimising impacts to groundwater and associated beneficial uses would be subject to independent peer review. This would provide further assurance of appropriate management of a key environmental aspect of the projects.

9.9.4 Auditing

Audits would be conducted by the appointed Alliance to monitor environmental performance, and to ensure continued conformance with legislative, contractual and management system obligations. The level of audit activity outlined below is considered to be appropriate for the duration, scale and complexity of the construction work associated with the projects.

LXRA would participate in the Alliance's audit program.

The scope of each audit would typically involve an evaluation of the following:

- conformance with the EMS and CEMP
- contractual requirements
- compliance with the EPRs and any plans required to comply with the EPRs
- compliance with planning, environmental and heritage approvals
- responses to non-conformances, incidents, and complaints received
- effective implementation of monitoring programs
- compliance with the Incorporated Documents.

The projects would be subject to an audit within three months of commencement of project works (i.e. site establishment activities such as set-up/mobilisation, establishing no-go-zones and laydown areas etc). As a minimum, audits would be scheduled to coincide with the commencement of key activities and the use of key equipment, and would be conducted on a quarterly basis (and more frequently where necessary) through delivery. A final audit would be undertaken upon or nearing completion to ensure all project requirements have been met, and the constructed assets can be handed over to the end asset owner.

The results of each audit would be presented in an audit report. Compliance would be assessed through observation of project activities, interviews and review of records. Records would include the following:

- environmental monitoring, process monitoring and management performance monitoring results
- inspection and audit reports
- soil and waste management records
- all monitoring records as required by the EPRs including noise, vibration, air, etc.
- surveys
- meeting minutes.

Environmental site inspections would also be conducted on a weekly basis by the appointed Alliance to monitor environmental performance. LXRA would also participate in one of the Alliance's weekly site inspections each month. The site inspections would comprise observations made during a site walkover and limited personnel interviews. Where appropriate, the focus of the site inspections would be guided by those activities and locations which represent potentially higher levels of environmental risk.

9.10 Environmental performance requirements

9.10.1 Context

This section summarises the rationale and approach adopted in preparing the EPRs for the projects, and sets out the EPRs in Table 9.5. The projects would be delivered in accordance with approved EPRs that define the project-wide environmental outcomes that must be achieved during design, construction and operation of the projects (regardless of the solutions adopted). This performance-based approach allows for a delivery model with sufficient flexibility to encourage innovation by the private sector to determine how any recommended EPRs would be achieved.

The EES presents a risk-based assessment of environmental effects of the projects, in accordance with the EES Scoping Requirements. Potential mitigation measures are typically included in the EES as examples of how an environmental effect could be mitigated and to illustrate how an EPR could be implemented. However, the EES generally does not mandate or commit to a particular mitigation or management outcome.

In the same manner, the EPRs do not typically mandate or require a particular mitigation or management solution. Instead, the EPRs would be implemented by applying a risk-weighted assessment of the nature and extent of the relevant environmental effects, and the most practicable means of mitigating and managing those effects where required. This would ensure the management and mitigation measures are proportional to the effect they are designed to address and achieve the outcome prescribed by the EPR.

The Incorporated Documents would require the project to be constructed and operated in accordance with the EPRs approved by the Minister for Planning. The Alliance would comply with the EPRs and prepare necessary plans prior to commencement of their scope of work to document the approach to compliance with each EPR. Each Alliance would therefore have its own plans for compliance with EPRs.

Table 9.5 sets out the EPRs that define the environmental performance to be achieved in the design and construction of both projects.

9.10.2 Consultation required by the EPRs

Many EPRs require consultation to be undertaken with relevant stakeholders. The extent of consultation and outcomes would be documented to demonstrate compliance with the EPRs. In instances where the EPRs necessitate the involvement of a 'relevant authority', this is defined as the relevant responsible authority for the requirement specified. The responsible authority may be the Minister for Planning, Kingston City Council, Melbourne Water, EPA Victoria, VicRoads, Aboriginal Victoria or Heritage Victoria.

Consultation required under the EPRs may include meetings, workshops and exchange of documentation and correspondence between LXRA or its contractor and stakeholders, but would not necessarily require the submission of written documentation or draft plans for formal comment to any particular stakeholder.

Where an EPR is expressed as requiring or being subject to the agreement of a stakeholder, LXRA must use reasonable endeavours to reach agreement with that stakeholder to satisfy the EPR. If LXRA uses such reasonable endeavours but is unable to reach an agreement with the stakeholder, it may submit a request to the Minister for Planning to amend or remove the relevant EPRs (as part of the EMF) under the relevant clauses of the Incorporated Documents. Such a request must be accompanied by a written explanation of the reasonable endeavours used by LXRA in reaching an agreement on the subject matter of the EPR, and the stakeholders' responses.

9.10.3 Risk assessment

Environmental risks and impacts have been identified and assessed through the specialist investigations for the EES and a detailed environmental risk assessment process. As described in Chapter 4 *Assessment framework*, the objective of the environmental risk assessment was to identify key social, environmental and business risks associated with construction and operation of the projects, and to develop management and mitigation measures to reduce these risks. Attachment II *Environmental Risk Report* contains further detail on the risk assessment and the complete risk register developed for the EES.

As part of the CEMP, the Alliance would be required to develop a detailed environmental risk assessment based on the detailed design of the projects and consider the risks identified in the EES. The risk assessment would be required to be consistent with AS/NZS ISO 31000 : 2009 *Risk management – principles and guidelines*. The Alliance would be required to maintain a current risk register which would be considered a 'live' document, adopting regular reviews and updating the register in response to changes to design, construction or operational activities, work methods, new technology, legislation and policy, or the occurrence of incidents or complaints.

The risk assessment would link risks to the relevant EPRs to define the standard of management to be achieved to manage potential impacts. If, through review of the risk assessment, additional or modified EPRs are required, the EPRs would be revised and re-submitted to the Minister for Planning for approval (as described in Table 9.4).

Table 9.5 Environmental performance requirements

EPR		Discipline
AH1	**Cultural Heritage Management Plan** Comply with and implement any Cultural Heritage Management Plan approved under the *Aboriginal Heritage Act 2006* that applies to the projects.	Aboriginal heritage
AQ1	**Air quality (construction)** Manage construction activities to minimise dust, odour and other emissions in accordance with EPA Victoria Publication 480 *Environmental Guidelines for Major Construction Sites.*	Air Quality
AQ2	**Air quality management** Control the emission of smoke, dust, fumes and other pollution into the atmosphere during construction and operation, in accordance with the State Environment Protection Policy (Air Quality Management 2001) and State Environment Protection Policy (Ambient Air Quality) 1999.	Air Quality
B1	**Business Disruption Plan** Minimise impacts to local business through preparation and implementation of a business disruption plan. The business disruption plan must be consistent with an approved Community and Stakeholder Engagement Management Plan (EPR reference SC1) and include: a. transport planning prior to road closures to minimise impacts to business access and parking (EPR reference T1) b. a process for communication with traders and businesses c. management of potential amenity impacts during construction (EPR references AQ1, AQ2, NV2, and NV3).	Business
CL1	**Spoil Management Plan** Prior to construction (excluding preparatory works), prepare and implement a Spoil Management Plan(s) in accordance with relevant regulations, standards or best practice guidelines. The plan must be developed in consultation with EPA Victoria. The plan shall be prepared prior to the commencement of construction (excluding preparatory works) and include: a. applicable regulatory requirements b. identifying nature and extent of spoil (clean fill and contaminated spoil) across the construction areas c. roles and responsibilities d. identification of management measures for storage, handling and transport of spoil for the protection of health, amenity and the environment e. identification, design and development of specific management measures for temporary stockpile areas f. identifying potential sites for management for disposal of any spoil g. monitoring and reporting requirements h. identifying locations and extent of any prescribed industrial waste (including asbestos) and characterising prescribed industrial waste prior to excavation i. identifying suitable sites for disposal of prescribed industrial waste The Spoil Management Plan shall include an Acid Sulfate Soil Management Plan (refer to EPR reference CL2).	CASS/ Contamination/ Spoil

EPR		Discipline
CL2	**Acid Sulfate Soil Management Plan** Prepare and implement an Acid Sulfate Soil Management Plan prior to construction of the project to the satisfaction of EPA Victoria, in accordance with the Industrial Waste Management Policy (*Waste Acid Sulfate Soils*) 1999, EPA Victoria Publication 655.1 *Acid Sulfate Soil and Rock*, and relevant EPA regulations, standards and best practice guidance in consultation with EPA Victoria. This plan will include: a. identify locations and extent of potential acid sulfate soils. b. assess potential impact for human health, odour and the environment c. identify and implement measures to prevent oxidation of acid sulfate soils wherever possible d. identify suitable sites for management, reuse or disposal of acid sulfate soils.	CASS/ Contamination/ Spoil
CL3	**Waste management** Manage wastes during the construction of the projects through development and implementation of a Construction Environmental Management Plan in accordance with EPA Victoria Publication 480 *Environmental Guidelines for Major Construction Sites 1996*, EPA Victoria Publication 347.1 *Bunding 2015*, Australian Standard AS1940 *Storage and Handling of Flammable and Combustible Liquids*, and relevant EPA Victoria and Victorian WorkCover Authority regulations, standards and best practice guidance that includes: a. application of the waste management hierarchy in assessing waste management options b. contamination and waste management requirements (e.g. use of waste and recycling facilities, maintenance of a clean site policy) c. designated vehicle refuelling area d. chemical management procedures, such as minimising use and storage of chemicals on site, bunded storage facilities to ensure spills, washing residues, slurries or other contaminated water can be contained, and are managed/disposed of appropriately e. location and type of spill kits required f. staff training and competence requirements g. use of well-maintained plant to minimise the potential for spills to occur h. procedures to remove, treat and/or dispose soil that becomes contaminated due to a fuel or chemical spill i. storage of litter in bins from which it cannot escape (temporary fencing may be used as a secondary containment measure for litter).	CASS/ Contamination/ Spoil

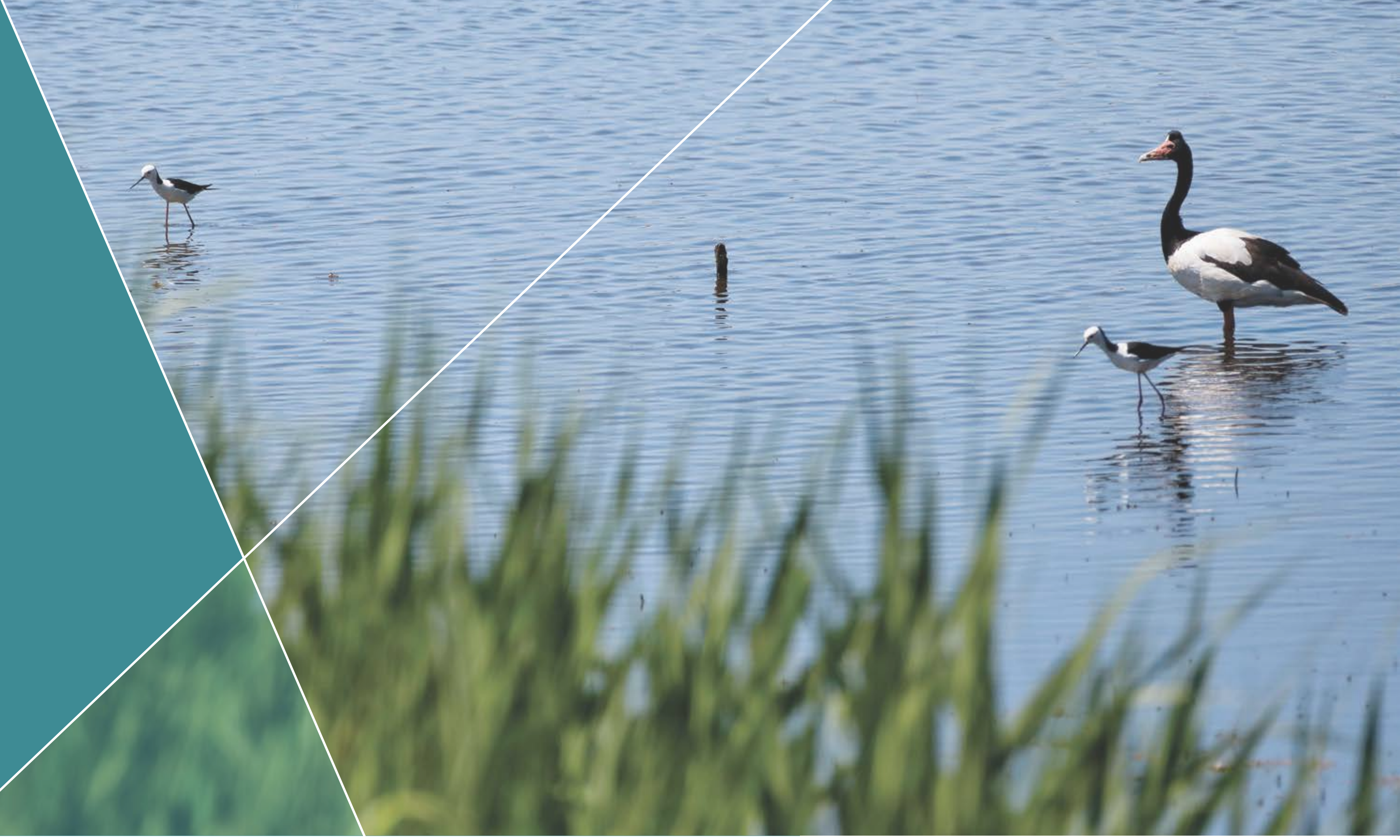
EPR		Discipline
CL4	**Acidic and/or contaminated groundwater (construction)** Develop and implement measures to manage acidic and/or contaminated groundwater, in accordance with the State Environment Protection Policy (Groundwaters of Victoria) 1997, State Environment Protection Policy (Waters of Victoria) 2004, State Environment Protection Policy (Prevention and Management of Contamination of Land) 2002, Water Industry Regulations 2006, and relevant EPA Victoria regulations, standards and best practice guidance, which must include: a. a baseline groundwater quality assessment (taking into account site history) at least three months prior to commencement of construction works, where applicable b. implementing a system to manage and/or dispose of intercepted groundwater (if required) which may be a trade waste agreement with relevant utility authority or other measures in accordance with relevant guidelines and legislation (if a trade waste agreement is not granted) c. collection, treatment, disposal and handling of contaminated groundwater and/or slurries, including vapours d. monitoring of intercepted groundwater quality monitoring during construction and water quality monitoring at run-off containment areas e. implementing contamination plume management (if required) f. treating and monitoring impacted groundwater (including vapours) prior to disposal, in accordance with licence and/or agreement.	CASS/ Contamination/ Spoil
CL5	**Acidic and/or contaminated groundwater (operation)** Prepare and fund the implementation of a Groundwater Quality Mitigation Plan in consultation with the land manager of any affected land parcels to manage and mitigate any impacts from changes to groundwater quality and/or levels as a result of the projects. The plan must include: a. measures to maintain or manage the beneficial use of groundwater affected by acidification b. measures to monitor and manage the beneficial uses of groundwater affected by contaminated groundwater plume migration attributable to the project(s) c. measures to maintain or manage impacts on beneficial uses as a result of changes to salinity in groundwater that is attributed to the project(s).	CASS/ Contamination/ Spoil
EMF1	**Environmental Management System** Implement an Environmental Management System during construction that is certified to AS/NZS ISO 14001: 2015 *Environmental management systems - Requirements with guidance for use.*	Environmental management
EMF2	**Environmental management plans** Prepare and implement a Construction Environmental Management Plan(s) and other plans as required by the EPRs. The management plan(s) should be prepared in accordance with EPA Victoria Publication 480 *Environmental Guidelines for Major Construction Sites* (EPA Victoria 1996). The process for development and implementation of the management plan(s) must include consultation as specified in the Environmental Management Framework, including with the Kingston City Council, VicRoads, Melbourne Water, EPA Victoria, as relevant to their statutory responsibilities. The management plan(s) must be in place prior to commencement of construction excepting ancillary activities, preparatory and enabling works.	Environmental management

EPR		Discipline
EMF3	**Environmental incidents** Prepare and implement a process for managing environmental incidents including: a. classification and definition of environmental incidents b. notification requirements (including timing) to LXRA and relevant regulators c. incident investigation.	Environmental management
FF1	**Native vegetation and habitat** Any native vegetation removal must be avoided, minimised and managed in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation 2017*.	Ecology
FF2	***Flora and Fauna Guarantee Act 1988* permits** A permit to take and destroy flora species protected under the *Flora and Fauna Guarantee Act 1988* is required. All permits must be obtained prior to the commencement of works which require approval under the Act.	Ecology
FF3	**Weeds and pathogens** Develop and implement measures to avoid the spread, or introduction of weeds and pathogens during construction, including vehicle and equipment hygiene.	Ecology
FF4	**Fauna** Minimise the removal of habitat for fauna. Where fauna habitat is identified for removal, engage a suitably qualified wildlife handler and recovery specialist to check for fauna occupancy and ensure compliance with the *Wildlife Act 1975*. All necessary authorisations must be obtained prior to commencement of works.	Ecology
FF5	**Protection of retained/adjacent vegetation and habitat** Minimise or avoid unintended impacts on retained and/or adjacent vegetation and habitat by including measures in the Construction Environmental Management Plan(s) and other plans including tree protection zones, environmental no-go zones, fencing and signage, directional lighting, and best practice spill, sedimentation and water runoff management.	Ecology
FF6	**Landscaping for wildlife** Incorporate native plant species into landscaping that provide wildlife habitat within level crossing removal project areas where appropriate.	Ecology

EPR		Discipline
FF7	**Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (foreshore native vegetation)** Prepare and fund the implementation of a Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (Foreshore Native Vegetation) in consultation with the land manager. The plan must: a. identify areas of coastal vegetation potentially impacted by a change to groundwater quality and/or levels as a result of the projects b. include a process to monitor groundwater to confirm any changes to groundwater quality and/or levels that could result in a loss of coastal native vegetation if required c. include a process for monitoring coastal native vegetation developed by a suitably qualified ecologist d. include criteria for determining whether a change in the extent or condition of coastal native vegetation is attributable to the projects e. include contingency measures to mitigate potential impacts attributable to the projects f. include the frequency and duration of monitoring if required. The plan would be implemented if trigger levels for changes to groundwater level and quality were identified by the groundwater monitoring program (see EPR reference GW3).	Ecology
FF8	**Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (Edithvale Wetland)** Prepare and fund the implementation of a Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (Edithvale Wetland) in consultation with the Commonwealth Department of Environment and Energy, Victorian Department of Environment, Land, Water and Planning, and the land manager. The plan must include: a. monitoring of groundwater level and water quality at representative and strategic locations within and around the Edithvale Wetland if required b. the frequency and duration of monitoring if required c. monitoring of surface water quality at representative and strategic locations within the wetlands to differentiate temporal trends from long term changes to groundwater if required d. criteria (levels and quality) for groundwater and surface water in and around the Edithvale Wetland for determining whether a change in groundwater levels and/or quality is attributable to the projects e. response measures in the event groundwater and surface water change criteria are met, such as: i. a process for ecological assessment developed by a suitably qualified ecologist to assess changes in aquatic fauna, birds and vegetation and consider whether these can be attributable to groundwater or surface water changes ii. criteria for determining whether a change in the extent or condition of the wetlands is attributable to the projects iii. contingency measures developed by a suitably qualified ecologist that would be implemented to mitigate potential impacts attributable to the projects iv. include the frequency and duration of monitoring. The plan would be implemented if trigger levels for changes to groundwater level and quality were identified by the groundwater monitoring program (see EPR reference GW3).	Ecology

EPR		Discipline
GM1	**Pre-construction condition survey** Conduct a pre-construction condition survey(s) for assets predicted to be affected by subsidence and/or ground movement. Develop and maintain a database of pre-construction and as-built condition information for each potentially affected structure identified as being in an area susceptible to damage (see EPR reference GM2), specifically including: a. identification of structures/assets which may be susceptible to damage resulting from subsidence or ground movement resulting from project works b. results of pre-construction condition surveys of structures, pavements, significant utilities and heritage overlay sites to establish baseline conditions and potential vulnerabilities c. records of consultation with land owners in relation to the condition surveys d. post-construction stage condition surveys conducted, where required, to ascertain if any damage has been caused as a result of project works e. share pre- and post-condition assessments and records of consultation with the property owner proactively f. ensure all stakeholder engagement activities are undertaken in accordance with the delivery partner's Community and Stakeholder Engagement Management Plan (see EPR reference SC1).	Land stability
GM2	**Repairs to properties due to vibration, subsidence or ground movement** For properties and assets affected by vibration, subsidence or ground movement, undertake required repair works or other actions as agreed with the property owner, where impacts are attributable to the project.	Land stability
GW1	**Rail trench design** The projects will be designed as rail trenches to meet applicable design standards and comply with the EPRs developed for the projects.	Groundwater
GW2	**Groundwater performance outcomes** The tanked rail trenches at Edithvale and Bonbeach must be designed to ensure that changes to ground water levels as a result of the projects do not result in: a. groundwater mounding that increase waterlogging at ground level b. groundwater drawdown that could cause ground subsidence and adverse impact to subsurface structures c. degradation to groundwater quality that would preclude protected beneficial uses of groundwater (salinity, contaminants, coastal acid sulfate soils) d. changes to groundwater that would have significant impacts on groundwater dependent ecosystems The performance of the installed rail trench will be monitored to confirm it is not having any impacts on groundwater levels and quality beyond those set out above (EPR reference GW3). Further monitoring and mitigation measures would be implemented if a change to groundwater level or quality that is not in accordance with this EPR is observed (EPR references FF7, FF8, CL5).	Groundwater

EPR		Discipline
GW3	**Groundwater Management and Monitoring Plan** Prior to construction (excluding preparatory works), prepare and fund the implementation of a Groundwater Management and Monitoring Plan to the satisfaction of EPA Victoria and relevant water authorities to manage predicted and potential impacts to groundwater following construction of the piled trench walls. The Groundwater Management and Monitoring Plan must be prepared prior to the construction of the pile walls and must include: a. detailed monitoring parameters including timing and location of monitoring bores b. duration of the monitoring program c. clear trigger levels for changes in groundwater level and quality that require mitigation plans to be implemented. The following plans for the monitoring and mitigation of impacts to specific environmental assets must be prepared prior to handover of the constructed asset to the rail infrastructure asset manager: a. Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (foreshore native vegetation) (EPR reference FF7) b. Groundwater Dependent Ecosystem Monitoring and Mitigation Plan (Edithvale Wetland) (EPR reference FF8) c. Groundwater Quality Mitigation Plan (EPR reference CL5). The plans would be implemented if trigger levels for changes to groundwater level and quality were identified by the groundwater monitoring program. The Groundwater Management and Monitoring Plan must include a program of monitoring for at least 10 years.	Groundwater
GW4	**Independent peer review** Prior to construction of the trench, independent peer reviews by an appropriately qualified specialist must be undertaken of the following: a. the proposed design of the Edithvale project to confirm that the proposed design is capable of achieving EPR reference GW2 b. the Groundwater Management and Monitoring Plan (EPR reference GW3).	Groundwater
HH1	**Unidentified historical archaeological sites** Minimise impacts on any unidentified historical archaeological sites and values discovered during construction through the development and implementation of an archaeological discovery protocol. The management protocol would be consistent with the *Heritage Act 2017* and developed in consultation with Heritage Victoria, and include a procedure for ceasing work if remains are discovered, notifying Heritage Victoria, obtaining consent and dealing with remains.	Historic heritage
HH2	**Heritage overlay sites** Avoid adverse impacts to the Chelsea Clock Tower and Chelsea Railway Station during construction through the implementation of no-go zones through the environmental management plan(s) and other plans if required. Undertake a pre-condition survey in accordance with EPR reference GM1.	Historic heritage



EPR		Discipline
HH3	**Heritage values** Avoid or minimise, to the extent practicable, adverse visual impacts on adjoining heritage places, and maintain landscape character and significant heritage precinct values (where relevant) by applying the urban design framework and project specific Urban Design Guidelines during the design development process.	Historic heritage
LP1	**Land use (construction)** The construction approach should: a. avoid or minimise impacts to existing land uses on private and public land (including public open space) from temporary works and permanent structures as far as practicable b. reduce the disruption, to the extent practicable, to current users of public and council land resulting from temporary occupation c. include opportunities to implement landscaping enhancement.	Land Use
LV1	**Landscape and visual opportunities** Minimise negative landscape and visual impacts, and maximise opportunities for enhancement of public amenity and facilities to the extent practicable, through the application of the Urban Design Guidelines specific to each project in consultation with relevant stakeholders, including Kingston City Council.	LVIA
LV2	**Lighting** Design lighting used during operation of permanent structures in accordance with relevant standards to minimise light spillage and protect the amenity of adjacent land uses to the extent practicable.	LVIA

<table>
<tr><th colspan="2">EPR</th><th>Discipline</th></tr>
<tr><td>LV3</td><td>
Light spillage
Light spillage must be minimised during construction to protect the amenity of adjacent land uses to the extent practicable.
The environmental management plan(s) and other plans must include requirements and methods to minimise light spillage, to the extent practicable, during construction to protect the amenity of adjacent and surrounding residential land uses, neighbourhoods, parks, community facilities including urban environments, and any known significant native fauna habitat, in consultation with relevant stakeholders.
</td><td>LVIA</td></tr>
<tr><td>NV1</td><td>
Operational noise
Design must ensure airborne noise generated by train movements at sensitive receptor locations are in accordance with the Passenger Rail Infrastructure Noise Policy 2013.
<table>
<tr><th>Time</th><th>Type of receiver</th><th>Investigation thresholds</th></tr>
<tr><td>Day
(6am – 10pm)</td><td>• Residential dwellings and other buildings where people sleep including aged persons homes, hospitals, motels and caravan parks
• Noise-sensitive community buildings, including schools, kindergartens, libraries</td><td>65 dBL_{Aeq} and a change in 3 dB(A) or more
or
85 dBL_{Amax} and a change in 3 dB(A) or more</td></tr>
<tr><td>Night
(10pm – 6am)</td><td>• Residential dwellings and other buildings where people sleep including aged persons homes, hospitals, motels and caravan parks</td><td>60 dBL_{Aeq} and a change in 3 dB(A) or more
or
85 dBL_{Amax} and a change in 3 dB(A) or more</td></tr>
</table>
Design fixed assets to achieve compliance with State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1.
</td><td>Noise /Vibration</td></tr>
</table>

EPR		Discipline
NV2	**Construction noise** Prior to construction (excluding preparatory works), prepare a Construction Noise and Vibration Management Plan for the projects in consultation with EPA Victoria and Kingston City Council. Manage construction noise and vibration in accordance with EPA Victoria Publication 1254 *Noise Control Guidelines, 2008* unless otherwise specified in the Construction Noise and Vibration Management Plan prepared for the projects. The Construction Noise and Vibration Management Plan must be prepared prior to commencement of construction (excluding preparatory works) and include: a. the identification of sensitive receptors along the project alignment b. details of construction activities and an indicative schedule for construction works, including the identification of noise and/or vibration generating construction activities that have the potential to impact sensitive receptors c. measures to ensure effective monitoring of noise and vibration associated with construction d. how construction noise (including truck haulage) and vibration will be minimised, including: i. the scheduling of noisy works to typical construction hours where feasible (i.e. Monday to Friday 07:00 am to 6:00 pm, and Saturday 07:00 am to 1:00 pm) ii. limiting night works outside of the main occupation periods iii. the planning of site works to limit vehicle movements to certain locations and time periods iv. the substitution of noisy plant or processes with quieter options (e.g. broadband reversing and movement alarms instead of conventional beepers) v. the provision of temporary noise barriers where practicable vi. monitoring of noise and/or vibration associated with construction vii. notifying residents who may be impacted by noise and/or vibration in advance of the works viii. a procedure for managing complaints. The plan must outline airborne noise management levels and mitigation measures for evening and night time works. The management level is not a noise limit or target, but represents noise levels above which community reaction may be adverse and which should trigger mitigation actions to minimise the noise impact. Depending on noise levels, noise mitigation measures may include an offer of respite and relocation, in accordance with a Respite and Relocation Policy (see EPR reference SC2) and Community and Stakeholder Engagement Management Plan (see EPR reference SC1).	Noise /Vibration

EPR		Discipline
NV3	**Construction vibration** Identify potential sensitive receptors (including heritage places) and potential impacts from vibration during the construction period. Where relevant, conduct condition surveys and monitoring of sensitive receptors. If impacts from vibration are anticipated, management and mitigation measures may include: a. substituting high vibration plant or processes with lower vibration options b. utilising vibration monitoring to inform management and mitigation c. relocation of residents (EPR reference SC2) d. communication with potentially affected residents in accordance with the Community and Stakeholder Engagement Management Plan (EPR reference SC1).	Noise /Vibration
SC1	**Community and Stakeholder Engagement Management Plan** Prior to construction (excluding preparatory works), prepare and implement a Community and Stakeholder Engagement Management Plan in consultation with Kingston City Council that: a. identifies all project activities that potentially impact on community and business operations, and provides for well-coordinated communication and engagement processes b. consults with and addresses needs of vulnerable groups that would be impacted by the project such as the elderly, socio-economically disadvantaged groups and children c. consults with and addresses needs of users of community facilities impacted by the project such as schools, child care, aged care, and caravan parks d. sets out processes and measures to provide advanced notice to key stakeholders and other potentially affected stakeholders of construction activities (including any staged works, early works, main works, or out of hours works), significant milestones, changed traffic conditions, interruptions to utility services, changed access and parking conditions, periods of predicted high noise and vibration activities, including contact details for enquiries/complaints e. provides for any interested stakeholder to register their contact details to ensure they are automatically advised of planned construction activities, project progress, mitigation measures and intended reinstatement measures where applicable f. documents a complaints management process (including processes and measures for registering, managing and resolving complaints) consistent with Australian Standard AS/NZS 10002: 2014 *Guidelines for Complaint Management in Organisations.*	Social

EPR		Discipline
SC2	**Respite and Relocation Policy** Prior to construction (excluding preparatory works), prepare and implement a Respite and Relocation Policy to be offered to residents whose amenity is significantly affected by construction activities (e.g. out of hours works or sustained loss of amenity during the day for residences with special circumstances such as shift workers), or who are subject to loss of access. The Respite and Relocation Policy will only apply during the period in which residents are (or are likely to be) affected. The Policy must contain: a. the criteria that must be met for relocation to be offered to affected residents b. consideration of special circumstances such as language or cultural need, special needs related to health conditions or home businesses c. the type and duration of out-of-hours work covered by the policy.	Social
SC3	**Recreational facilities** Where construction works directly impact on sports clubs or passive recreation users of directly impacted sporting and recreational facilities, work with affected sporting clubs and land managers to identify appropriate management measures, including provision of alternative facilities for the period of disruption.	Social
SS1	**Sustainability** Achieve LXRA's sustainability policy to: a. demonstrate leadership in the commitment to a prosperous and integrated economic, social and environmentally sustainable future b. seek opportunities to enhance the value of natural systems c. pioneer innovation in sustainable design that seeks continuous improvement.	Sustainability
SS2	**Climate change** Design projects in accordance with the most up-to-date climate change assumption guidance provided in the *Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria* (DELWP, 2016) and the *Planning for Sea Level Rise Guidelines* (Melbourne Water, 2017) in order to manage climate change uncertainty in design, construction and operation.	Sustainability

EPR		Discipline
SW1	**Stormwater management - construction** Protect local waterways by applying best practice sedimentation and pollution control measures in accordance with EPA Victoria publication 480 *Environmental Guidelines for Major Construction Sites* through the Construction Environmental Management Plan(s) and other plans. Implement a water collection and treatment system to ensure that stormwater discharges comply with the State Environment Protection Policy (Waters of Victoria) 2004.	Surface Water
SW2	**Water quality - operation** The design must include a water collection and treatment system to ensure that stormwater discharges comply with State Environment Protection Policy (Waters of Victoria) 2004 and do not impact beneficial uses of that waterbody. This would include adopting water sensitive urban design and integrated urban water management principles in the stormwater management design, in accordance with the LXRA's Urban Design Framework and the specific Urban Design Guidelines for the projects, and urban stormwater EPA Victoria publication 480 *Best Practice Environmental Management Guidelines 1996* in consultation with Melbourne Water and Kingston City Council as applicable.	Surface Water
SW3	**Drainage network - construction** Design surface water discharge to have no adverse impact to the drainage network capacities in consultation with Melbourne Water and Kingston City Council as required.	Surface Water
SW4	**Drainage network – operation** Design surface water discharge to have no adverse impact to the drainage network capacities in consultation with Melbourne Water and Kingston City Council as required.	Surface Water
SW5	**Flood protection - construction** Maintain existing levels of flood protection associated with overland flow paths (considering flood levels, flows and velocities) during temporary construction works through compliance with Melbourne Water and Kingston City Council requirements for flooding and overland flows.	Surface Water
SW6	**Flood protection - operation** Design infrastructure to maintain existing levels of flood protection associated with overland flow paths (considering flood levels, flows and velocities) through compliance with Melbourne Water and Kingston City Council requirements for flooding and overland flows.	Surface Water

EPR		Discipline
T1	**Transport Management Plan** Prior to the commencement of construction (excluding preparatory works), develop and implement a Transport Management Plan(s) to minimise disruption (to the extent practicable) to affected local land uses, traffic, car parking, on-road public transport, pedestrian and bicycle movements and existing public facilities during all stages of construction. The plan(s) must be developed in consultation with the relevant road management authorities and be informed and supported by an appropriate level of transport analysis. The plan(s) must include: a. a monitoring program to monitor impacts of construction activities to all modes of active and passive transport. Where monitoring identifies adverse impacts, practicable mitigation measures must be developed and implemented b. consideration of cumulative impacts of other major projects operating concurrently in the local area c. identify the route options for construction vehicles (including haulage of spoil and other heavy materials to and from site) travelling to and from the project construction site, recognising sensitive receptors, and minimising the use of local streets where practicable d. be prepared in consultation with emergency services, develop suitable measures to ensure emergency service access is not inhibited as a result of project construction activities e. allow for the provision of alternative parking where practicable to replace public and commuter parking lost as a result of project construction activities and to prevent construction-related parking on local roads or use of public car parks f. allow for the provision of car parking or park and ride facilities for construction workers g. provisions for the minimisation of impacts on existing connectivity for pedestrians, cyclists, public transport and road vehicles as a result of construction (including laydown areas), including the identification of alternative routes for pedestrians and cyclists and other measures to maintain connectivity and safety for pedestrians and cyclists h. management of any temporary or partial closure of roads and traffic lanes, including provision for suitable routes for vehicles, cyclists and pedestrians, to maintain connectivity for road and footpath users i. an approach for maximising the current road capacity on Nepean Highway and Edithvale Road during peak periods j. restrictions to the number of local roads to be used for construction-related transportation to minimise impacts on amenity, in consultation with the relevant road authorities k. reinstatement of access to open space, community facilities, commercial premises and dwellings if disrupted, as soon as practicable, and to an equivalent standard l. provision for safe access points to laydown areas and site compounds m. a communications strategy to advise affected users, potentially affected users, relevant stakeholders and the relevant road authorities of any changes to transport conditions in accordance with the Community and Stakeholder Engagement Management Plan (EPR reference SC1). The plan may include specific measures for discrete components or stages of the works having the potential to impact on roads, shared use paths, bicycle paths, footpaths or public transport infrastructure.	Traffic

EPR		Discipline
T2	**Public Transport Disruption Management Plan** Prior to commencement of works significantly affecting public transport services, develop and implement a plan for minimising disruption to public transport services (rail, bus) resulting from project construction activities. The plan must be developed in consultation with VicTrack, V/Line, Public Transport Victoria, the Department of Economic Development, Jobs, Transport and Resources (Transport) and Metro Trains Melbourne, as relevant.	Traffic
T3	**Pedestrian and cyclist connectivity** Optimise the design in accordance with the principles and objectives of LXRA's Urban Design Guidelines to maintain and enhance pedestrian and cyclists connectivity in consultation with relevant road authorities, Kingston City Council and Public Transport Victoria where appropriate.	Traffic
T4	**Intersection design and performance** Intersections must be designed and constructed to provide safe vehicle movements to the satisfaction of the responsible road management authority. Undertake an intersection analysis to ensure acceptable intersection performance.	Traffic
T5	**Car parking** Where practicable, ensure no net loss in station car parking for rail users upon completion, and car parking must be replaced or reinstated at the earliest opportunity.	Traffic
T6	**Vehicle and pedestrian access** Where vehicle and pedestrian access are altered during construction, ensure that vehicle and pedestrian access is replaced, in accordance with relevant road design standards.	Traffic
T7	**Debris on roads** Minimise dirt and debris on the roads from construction activities by measures including: a. street sweeping b. covering all truck loads that have the potential to result in debris on public roads c. cleaning vehicles and tyres when leaving construction sites.	Traffic
T8	**Emergency services** Maintain vehicular and pedestrian access to hospital emergency departments at all times during construction and to other key health and medical facilities, where practicable.	Traffic

EPR		Discipline
UD1	**Urban Design Guidelines** Design projects in accordance with the LXRA Urban Design Framework and project specific Urban Design Guidelines. The Urban Design Guidelines must consider: a. identity b. connectivity and wayfinding c. urban integration d. resilience and sustainability e. amenity f. vibrancy g. safety h. accessibility Seek the advice of the LXRA Urban Design Advisory Panel (chaired by the Office of the Victorian Government Architect, and includes officers of Kingston City Council) during the preparation of detailed design to ensure an appropriate response to the LXRA Urban Design Framework.	Urban design
UD2	**Hoardings** Minimise visual impacts during construction (where possible) with the installation of hoardings. Hoarding must be installed to LXRA's hoarding requirements in consultation with the Kingston City Council.	Urban design

8 POTENTIAL LOCAL IMPACTS AT EDITHVALE AND BONBEACH

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8.1 Introduction

This chapter discusses the potential environmental effects during construction and operation at both project sites that may require management through an Environmental Management Framework, as required by Section 3.5 of the Scoping Requirements. It discusses how these activities, and associated changes, would affect either the physical environment or the community surrounding the level crossings.

The assessment of impacts is based on the construction and operation activities described in Chapter 2 *Rationale and project descriptions*.

The impact assessment is made up of a number of specific studies on the following aspects of the environment:

- noise and vibration (Section 8.2)
- traffic (Section 8.3)
- historic heritage (Section 8.4)
- Aboriginal cultural heritage (Section 8.5)
- surface water (Section 8.6)
- air quality (Section 8.7)
- social (Section 8.8)
- business (Section 8.9)
- landscape and visual (Section 8.10)
- ecology within project areas (Section 8.11)
- land use (Section 8.12).

The potential impact of the projects on each of these aspects of the environment has been studied in detail by qualified specialists. The detailed impact assessments are provided in the attached Technical Reports D to N.

The impact assessment studies have been used to inform the risk assessment process outlined in Chapter 4 *Assessment framework*, and the preparation of Environmental Performance Requirements (EPRs).

The EPRs have been developed to ensure that potential impacts surrounding the project sites can be avoided, minimised or managed to reduce the level of risk from the projects. A complete listing of the EPRs is available in Chapter 9 *Environmental Management Framework*, as required by Section 3.5 of the Scoping Requirements for the EES issued by the Minister for Planning (September 2017). The EPRs should be read in conjunction with this chapter.

This chapter includes a section on each aspect of the environment listed above. Each section includes a table showing the risk pathways associated with the relevant environmental aspect and a rating that shows the level of residual risk after the final EPRs developed to manage the risks are in place.

A full breakdown of each risk and risk rating presented in this chapter is provided in Attachment II *Environmental Risk Report*.

Potential operational risks for groundwater are discussed in Chapter 5 *Modelling the water environment*, the Edithvale-Seaford Wetlands are discussed in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* and potential impacts associated with coastal acid sulfate soils and contamination are discussed in Chapter 7 *Acid sulfate soils and contamination*.

8.2 Noise and vibration

Noise and vibration have the potential to cause annoyance and interfere with everyday life. Construction of the projects would generate noise and vibration from the use of construction machinery, excavation, installing piles, building new railway infrastructure and roadworks.

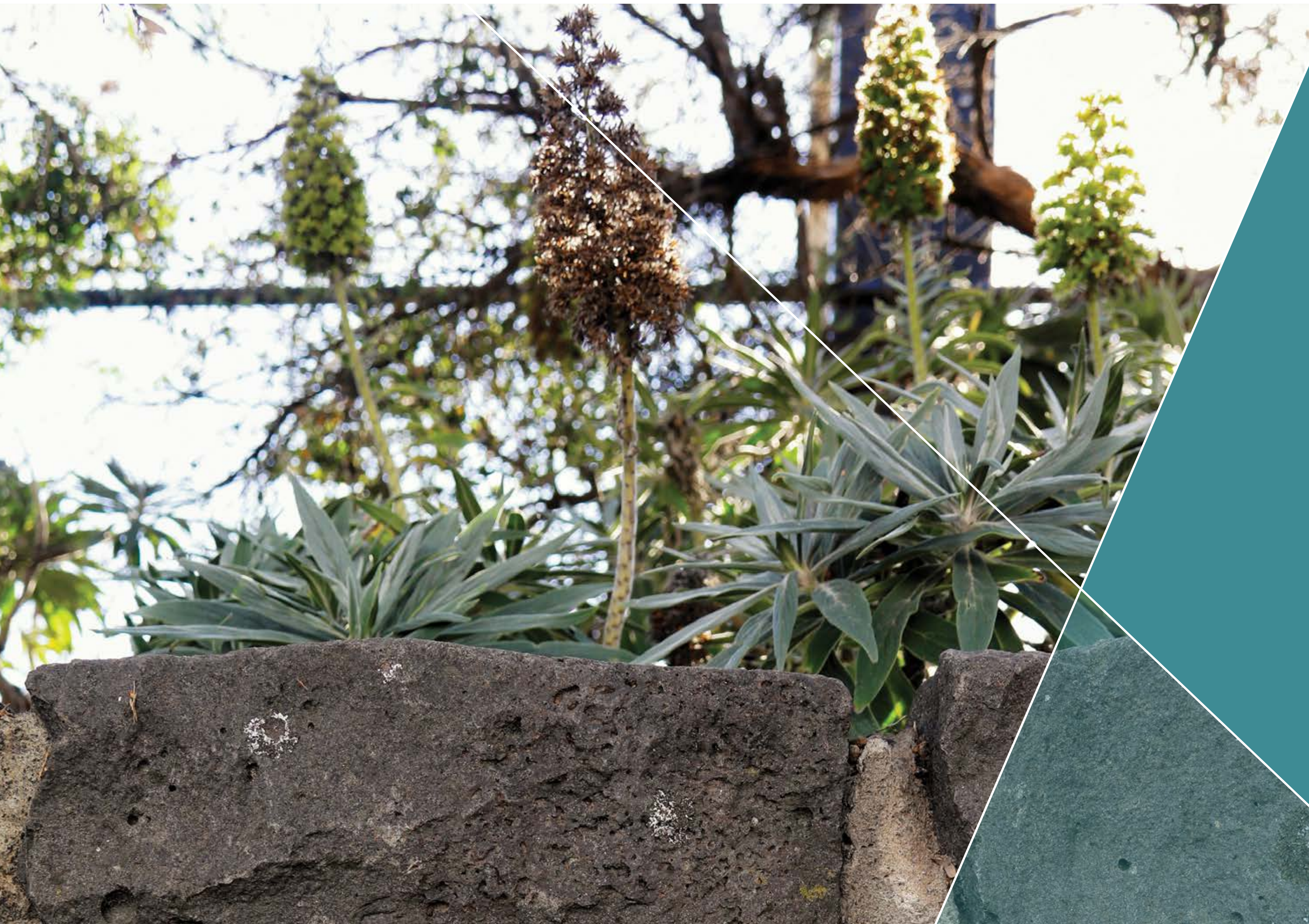
This has the potential to reduce amenity near the works. The extent to which this occurs would depend upon the duration of the activity and the level of noise and vibration it generates. Management of noise and vibration during construction is important to minimise amenity impacts, and prevent vibration-induced structural damage.

Train movements are also a source of noise and vibration, and have the potential to affect human health, amenity, infrastructure and other assets. As the project would alter the physical environment through which trains would pass, the changes to existing levels of noise and vibration during operation have been assessed in order to understand the potential impacts on sensitive receptors.

What is a sensitive receptor?

Sensitive receptors are locations, assets, values or uses that are considered to be sensitive to a particular activity or impact that would affect its continued use.

Examples include residences, aged care and schools which may be sensitive to amenity impacts such as noise



Measurements of noise

The following terminology is used throughout the assessment:

- A–weighted decibel, abbreviated to dB(A), is a unit used to represent sound pressure level on a logarithmic scale. A-weighting (A) is a frequency filter applied to measured noise to represent how the human ear hears sound. Noise limits applicable to environmental impacts are typically specified in terms of dB(A).
- L_{Aeq}, is the equivalent continuous sound pressure level measured over a specific period (in dBA), and is often referred to as the average sound pressure level over time. There are two versions of L_{Aeq} that have been used for this assessment:
  - $L_{Aeq,16hr}$, is the continuous sound pressure level measured during 'day-time', being the 16-hour period from 6am to 10pm.
  - $L_{Aeq,8hr}$, is the continuous sound pressure level measured during 'night-time', being the 8-hour period from 10pm to 6am.
- LAmax, is the maximum 'A'-weighted sound pressure level that occurs during a given measurement period. This value represents the 95th percentile of the loudest sound pressures reached.

Changes in noise levels typically need to exceed 3 dB(A) before they are perceptible to the human ear, as demonstrated by Table 8.1.

Table 8.1 Perceived change in decibel levels

Change in sound level	Perceived change to the human ear
±1dB	Not perceptible
±3dB	Threshold of perception
±5dB	Clearly noticeable
±10dB	Twice as loud

A noise and vibration impact assessment has been prepared and is provided in Technical Report H *Noise and Vibration*. This section summarises the outcomes of the assessment of construction and operational impacts as a result of the Edithvale and Bonbeach level crossing removal projects.

8.2.1 Existing conditions

Noise

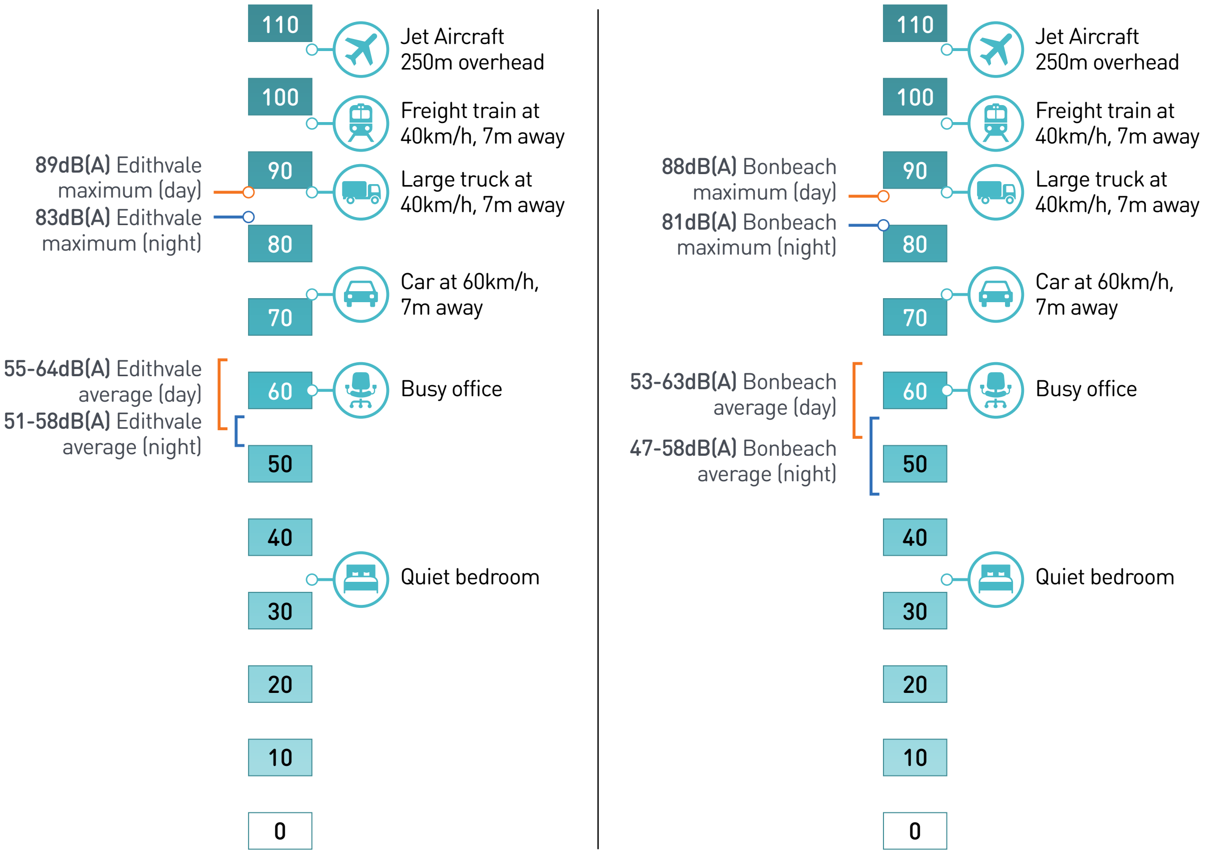
The closest noise sensitive receptors near the projects are the residential properties located along Nepean Highway and Station Street. At these locations, the local noise environment is largely dominated by road traffic noise from Station Street and Nepean Highway, as well as rail traffic noise along the Frankston rail line. The receptors near both the Edithvale and Bonbeach sites currently experience similar noise conditions.

Monitoring of the existing noise conditions was undertaken at sensitive receptors across both sites. At Edithvale, the average daytime noise level was recorded between 55 and 64 LAeq,16hr, while at night it was typically between 51 and 58 LAeq,8hr. The maximum noise level experienced at Edithvale during the day was 89 LAmax, and during the night it was 83 LAmax.

At Bonbeach, the average daytime noise level was recorded between 53 and 63 LAeq,16hr, while at night it was typically between 47 and 58 LAeq,8hr. The maximum noise level experienced at Bonbeach during the day was 88 LAmax, and during the night it was 81 LAmax.

Figure 8.1 presents a comparison of these average and maximum noise levels to familiar typical noise levels. These results are typical of the noise levels expected to be experienced by residents living adjacent to busy roads.

Figure 8.1 Existing noise levels recorded at Edithvale (left) and Bonbeach (right) compared to some typical noise levels



Vibration

Vibration also has the potential to affect amenity and is therefore measured in terms of its likelihood to lead to 'adverse comments', whereby occupants express negative responses to vibration, as defined by British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings*. This standard specifies the vibration dose values (VDV) used to assess the human response to vibration impacts.

Vibration measurements were recorded six metres from the track to understand the existing typical vibration levels at Edithvale and Bonbeach that are generated by passing trains.

As shown in Table 8.2, the vibration levels recorded were below the level at which adverse comments are generally reported, according to vibration standards BS6472-1:2008. As a result, the vibration currently caused by passing trains is unlikely to affect amenity at nearby sensitive receivers. No other sources of vibration are known to exist near the projects.

Table 8.2 Vibration Dose Values (VDV) compared to criteria at closest sensitive uses

Scenario	Day ($m.s^{-1.75}$)	Night ($m.s^{-1.75}$)
Passenger trains	0.016	0.010
Freight trains	0.005	0.004
All train movements	0.016	0.010
Criteria (VDV for low probability of adverse comments)	**0.2 to 0.4**	**0.1 to 0.2**

8.2.2 Construction impact assessment

The noise and vibration risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are summarised in Table 8.3. The risk levels are the residual risk remaining after the implementation of the EPRs and controls discussed below.

Table 8.3 Noise and vibration risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual risk
NV15	Night-time construction noise	Night-time noise during construction exceeds limits causing loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan EPR SC2 Respite and Relocation Policy	Moderate
NV16	Night-time construction noise (unplanned)	Unplanned night-time noise during construction exceeds limits causing loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan	Minor
NV17	Day-time construction noise	Day-time noise during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan EPR SC2 Respite and Relocation Policy	Minor
NV19	Day-time construction noise (unplanned)	Unplanned day-time work during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan	Negligible
NV20	Vibration (Amenity)	Vibration exceeds limits resulting in loss of amenity.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan	Minor
NV21	Vibration (Structure damage)	Vibration during construction results in structural damage.	EPR GM1 Pre-construction condition Surveys	Negligible

Construction Noise

It is acknowledged that construction activities generate noise, and would be particularly impactful during the main occupation where works would be occurring 24 hours a day (for further information of the main occupation, refer to Chapter 2 *Rationale and project descriptions*). During construction, noise pollution (particularly occurring near built-up areas) may cause annoyance to neighbouring communities. During this time, LXRA is committed to delivering the projects in accordance with the specific EPRs developed for the projects and current guidelines and standard requirements to manage all noise impacts during the construction phase, aiming to ensure that impacts to community amenity are minimised.

To limit potential impacts resulting from construction noise undertaken during the evening, at night, or on weekends, the Victorian EPA's *Noise Control Guidelines*, Publication 1254, October 2008 would be used as a guideline. As shown in Table 8.4, these guidelines do not specify criteria for construction activities undertaken during the day, but do for activities outside normal working hours.

Table 8.4 Adopted construction noise criteria

Time	Construction noise criteria
Normal working hours • 7am to 6pm Monday to Friday • 7am to 1pm Saturday	No specific limits
Weekend and evening hours • 6pm to 10pm Monday to Friday • 1pm to 10pm Saturday • 7am to 10pm Sunday	10 dB(A) above existing background levels for a period of up to 18 months 5 dB(A) above existing background levels after 18 months
Night period • 10pm to 7am Monday to Sunday	Noise must be inaudible within a habitable room of any residential premises

(Source: EPA's Noise Control Guidelines, Publication 1254, October 2008)

Night-time noise (risks NV15 and NV16)

Noise-generating construction activities would occur at night during the main six-week occupation period when the rail corridor is closed to enable construction of the proposed rail trenches, as well as intermittently during site preparation and piling works.

Given the residential nature of the Edithvale and Bonbeach areas, the receptors at both sites that have the highest potential to be affected by any changes to noise conditions are residential dwellings along Station Street and Nepean Highway adjacent to the project works. Noise impacts may also be experienced by residents further back from the existing rail alignment.

Noise levels would be managed in accordance with Victorian EPA's *Noise Control Guidelines* where possible. Where it is not possible to meet these or the requirement that noise must not be audible within a habitable room of a residence between 10pm and 7am, a Construction Noise and Vibration Monitoring Plan (CNVMP) would be implemented to minimise the potential for noise impacts to sensitive receptors (EPR reference NV2). Measures would be implemented to minimise the risk of impacts from construction noise, including:

- identifying sensitive receptors along the project alignment
- details of construction activities and an indicative schedule for construction works, including the identification of noise generating construction activities that have the potential to impact sensitive receptors
- standard noise management measures such as:
  - scheduling noisy works to typical construction hours where feasible (i.e. Monday to Friday 7am to 6pm, and Saturday 7am to 1pm).
  - limiting night works outside of the main occupation periods
  - planning site works to limit vehicle movements to certain locations and time periods
  - substituting noisy plant or processes with quieter options (e.g. broadband reversing and movement alarms instead of conventional beepers)
  - providing temporary noise barriers where practicable
  - monitoring of noise associated with construction
  - notifying residents who may be impacted by noise in advance of the works
  - a procedure for managing complaints.

The measures outlined above (EPR reference NV2) would be implemented to minimise the noise generated during the evening and night time works for all project phases to minimise noise impact as much as possible.

During the main occupation, works would occur 24 hours a day to minimise the length of time that the railway is closed. Complete avoidance of noisy works during the evening and night time would extend the main occupation and rail closure from the proposed six weeks to at least 12 weeks, resulting in significant additional disruption to the approximately 40,000 people who use the Frankston rail line each day.

During the main occupation period, reduction of the night and evening construction noise levels to comply with the EPA guideline limits is unlikely to be possible for all receptors because of their proximity and the intensity of construction activities. Construction noise levels during the night and evening are predicted to exceed the guideline limits recommended by EPA Victoria on occasion during the six-week main occupation period at some receptor locations. This may mean noise levels would be 10 dB(A) or more above existing background levels during the evening, or audible within a habitable room of residential premises during the night.

In these circumstances, the CNVMP must outline airborne noise management levels and mitigation measures for evening and night time works. The management level is not a noise limit or target, but represents noise levels above which community reaction may be adverse and which should trigger mitigation actions to minimise the noise impact. Depending on noise levels, noise mitigation measures may include:

- offer of respite
- offer of relocation in accordance with a Respite and Relocation Policy (EPR reference SC2) and Community and Stakeholder Engagement Management Plan (EPR reference SC1).

A key mitigation for night time noise is the development and implementation of the Respite and Relocation Policy, once a detailed understanding of the noise impacts from construction are known (EPR reference SC2). The relocation policy would be developed and implemented by the Alliance that is formed to deliver the projects (for more information on the Alliance approach to delivering the projects, see Chapter 9 *Environmental Management Framework*). The relocation policy would provide the option for residents affected by night time noise during construction to be temporarily relocated during noisy works.

A Community and Stakeholder Engagement and Management Plan (EPR reference SC1) would be developed and implemented to ensure that clear and timely engagement occurs to inform the community about noisy works. The plan would ensure the community is aware of potential impacts, assist in minimising noise-related disturbance and provide guidance for advising residents about the relocation policy.

Some impacts from noise during construction works would result in a loss of amenity, including disruption associated with relocation. The risk associated with night-time noise from construction has been assessed as moderate given that receptors have the potential to be impacted during the main occupation period, however a relocation policy would be in place and clear, timely information regarding noisy works would be provided.

There is also the potential for the adopted EPA noise limits (as set out in Table 8.4) to be unexpectedly exceeded at night-time for unplanned activities occurring during site preparation works (outside of the main occupation period). Unplanned noise activities may include late oversize deliveries to site, or daytime works that overrun into the evening or night (such as time critical concrete pours). These activities may affect local amenity and result in complaints from the community. To control this risk, the CNVMP would be implemented, specifying measures to minimise noise (EPR reference NV2), as well as a complaints management system (EPR reference SC1) and onsite noise monitoring (EPR reference NV2). As a result, any impact would be unlikely and short term, and the risk of a loss of amenity due to unplanned noise therefore has a minor rating.

Day-time noise (risks NV17 – NV19)

There are no set EPA noise limits prescribed for day-time construction work. Day-time construction works would occur over an 18-month period, with variable levels of noise generated during that time.

Noise levels would generally be managed through scheduling and planning of works, in accordance with the CNVMP (EPR reference NV2). Given that noisier works would be planned for the daytime and that the noise sensitive receivers would generally be located more than 20 metres away from the main construction machinery, day-time noise levels generated by the works would be noticeable at receptors but are expected to be within a range that would be considered reasonable for short periods.

A Community and Stakeholder Engagement Management Plan (CNVMP) would be implemented for community stakeholders and land owners potentially affected by noise and vibration from construction works, specifying the requirements to provide advanced notice of works (planned) and procedures for resolving complaints (EPR reference SC1). Therefore, the risk of daytime noise resulting in a loss of amenity would have a minor rating.

Unexpectedly noisy works also have the potential to occur during the day-time for time-critical activities. These would be minimised through the implementation of the CNVMP (EPR reference NV2) and the impact would be temporary in nature; therefore this has a negligible risk rating.

Construction Vibration

Construction activities that cause vibration have the potential to affect sensitive receivers within the study area by affecting amenity or through structural damage to buildings. The activity with the greatest potential for vibration impacts to receivers is piling. Other construction activities that may cause vibration impacts include earthworks and ground compaction.

Vibration – amenity (risks NV20)

The receptors that have the potential to be impacted by amenity changes due to vibration generated by the projects are the residential dwellings along Station Street and Nepean Highway. Vibration Dose Values (VDVs) for human comfort are provided in Table 8.2.

Driven piles are likely to have vibration impacts at nearby receivers and the VDVs for human comfort may be exceeded. Dynamic pile testing could also potentially exceed the VDVs for human comfort at nearby receptors.

However, management of risk of impacts from vibration levels would be provided through an assessment of potential impacts expected during construction based on known construction methods (EPR reference NV3). This may require monitoring of sensitive receptors. If impacts from vibration are anticipated, mitigation measures may include:

- substituting high vibration plant or processes with lower vibration options
- using vibration monitoring to inform management and mitigation
- communication with potentially affected residents through the Community and Stakeholder Engagement Management Plan (EPR reference SC1) to give advanced warning to residents of the impending works
- respite or relocation of residents (EPR reference SC2), if necessary

The likelihood of this risk occurring is low, and as a result the impact would generally be short-term and temporary in nature, and therefore the loss of amenity would be a minor risk.

Vibration – structure damage (risks NV21)

Guideline values for structural damage are adopted from the German Standard DIN 4150-3: 1999 *Vibration in buildings – Part 3: Effects on structures*, and summarised in Table 8.5.

Table 8.5 Adopted construction vibration limits for structures

Type of structure	Vibration at the foundation (mm/s)			Vibration (mm/s) at horizontal plane of highest floor
	At a frequency of 1 Hz to 10 Hz	At a frequency of 10 Hz to 50 Hz	At a frequency of 50 Hz to 100 Hz	
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40
Residential dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20	15
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value	3	3 to 8	8 to 10	8

The potential for structural damage would be controlled by identifying the structures with the potential to be impacted by vibration during the construction period, and if necessary, completing condition surveys and monitoring of these structures (EPR reference NV3).

Contingency measures would be implemented, if necessary, as a result of the monitoring to reduce vibration levels. With the adoption of these controls, and due to the distance between the construction activities and receptors, it is unlikely that structural damage limits in Table 8.5 would be exceeded. Therefore, the risk of vibration levels resulting in structural damage would be negligible.

From the risk assessment, the greatest noise and vibration risk identified during construction was night time works during the main occupation. This work would occur over a six-week period and could not be further mitigated. The other risks from noise or vibration could occur throughout the 18-month construction period. The residual risk is considered to be negligible after management and mitigation is in place.

8.2.3 Operation impact assessment

The noise and vibration risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects are summarised in Table 8.6. The risk levels presented are the residual risk remaining after the implementation of the EPRs and controls discussed below.

Table 8.6 Noise and vibration risks – Operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual risk
NV14	Night time operational noise	Night-time noise during operation exceeds limits causing loss of amenity at sensitive receptors.	EPR NV1 Operational noise	Negligible
NV18	Day-time operational noise	Day-time noise during operation exceeds limits causing loss of amenity at sensitive receptors.	EPR NV1 Operational noise	Negligible
NV20	Vibration (amenity)	Vibration exceeds limits resulting in loss of amenity.	No EPR required	Negligible

Passenger and freight trains

Noise thresholds

The Victorian Government's Passenger Rail Infrastructure Noise Policy (PRINP) has been established to guide transport bodies and planning authorities in their consideration of the impacts of rail noise from improved or new passenger rail infrastructure. The PRINP investigation thresholds are outlined in Table 8.7. Options for avoiding, minimising and mitigating railway noise should be considered if noise exceeds the investigation thresholds.

Table 8.7 PRINP investigation thresholds for redevelopment of existing passenger rail infrastructure

Time	Type of receiver	Investigation threshold(s)
Day (6am to 10pm) dB(A)	Residential dwellings and other buildings where people sleep including aged person homes, hospitals, motels and caravan parks. Noise sensitive community buildings including, schools, kindergartens and libraries	65 dB(A) L_{Aeq} and change in L_{Aeq} of 3 dB(A) or more **or** 85 dB(A) L_{Amax} and change in L_{Amax} of 3 dB(A) or more
Night (10pm to 6am) dB(A)	Residential dwellings and other buildings where people sleep including aged person homes, hospitals, motels and caravan parks	60 dB(A) L_{Aeq} and change in L_{Aeq} of 3 dB(A) or more **or** 85 dB(A) L_{Amax} and change in L_{Amax} of 3 dB(A) or more

(Source: Table C, Attachment 2 of PRINP)

Train noise modelling

Noise modelling was done to understand any changes to the noise environment as a result of train movements after the construction of the projects.

Noise levels were modelled to predict average (LAeq) and maximum (LAmax) noise levels from trains for both day-time and night-time periods. Under the PRINP, the assessment of maximum noise levels (or L_{Amax}) is based on the 95th percentile.

Two scenarios were modelled for comparison — the current situation (without the projects), and following delivery of the projects (with the projects). The model was set up to simulate the movements of the three different types of train that occur on the Frankston rail line:

- electric passenger trains – noise from electric passenger trains is typically generated by the interaction between wheel and rail
- diesel passenger trains – similar to electric trains, noise is created by the interaction of wheel and rail, as well as additional noise from the diesel engine
- freight trains – these are typically diesel operated and involve a locomotive pulling along trailing wagons. Noise from freight trains consists of engine noise from the locomotive (typically from the exhaust at the top of the locomotive), and noise from the interaction of wheel and rail for freight wagons.

Upon the completion of the projects, the number of trains assumed to pass through the study area each day are shown in Table 8.8.

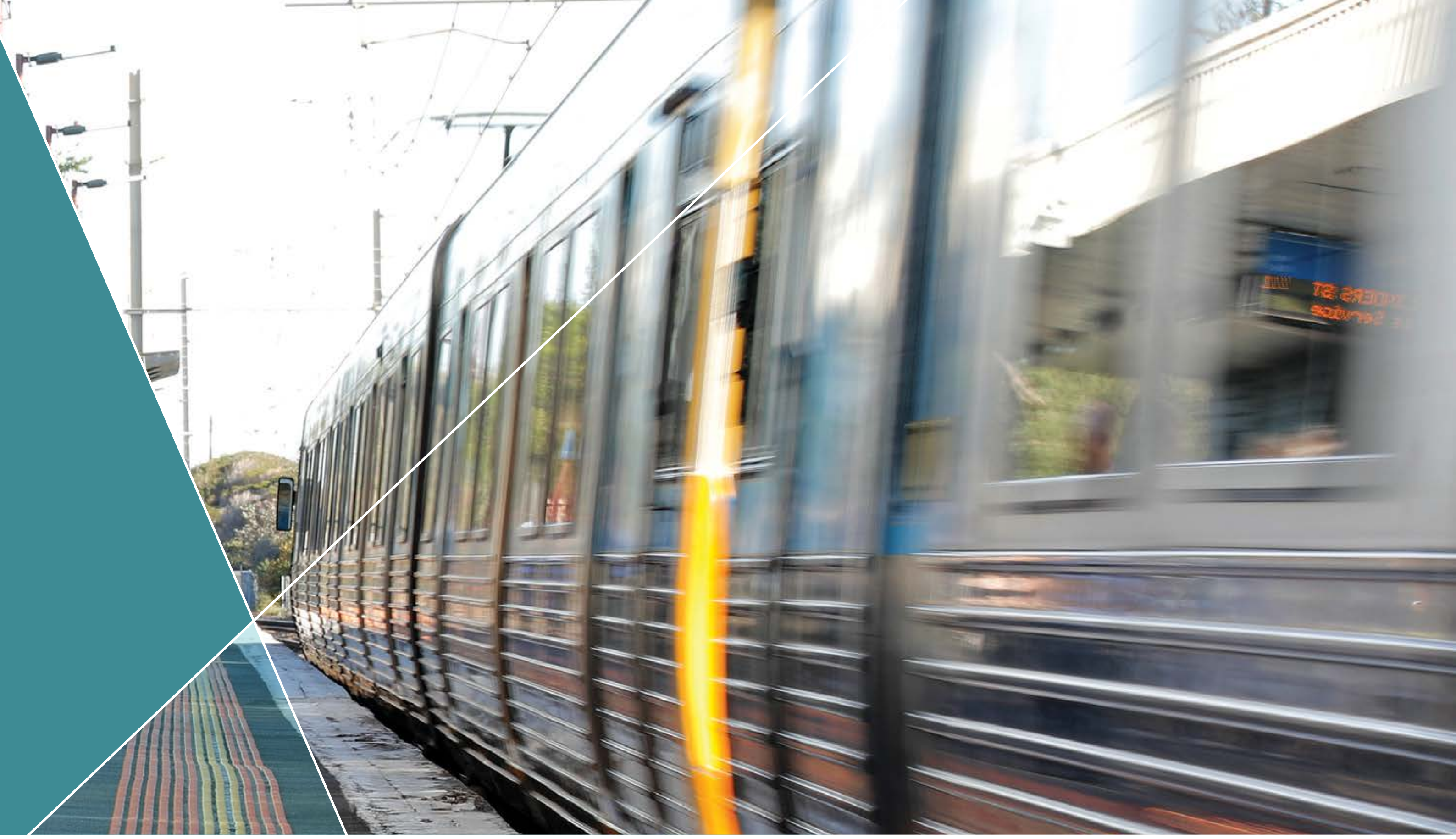


Table 8.8 Train movements considered by the noise model at project opening

Vehicle type	Length	Speed	From city: Day	From city: Night	To city: Day	To city: Night
Electric passenger train	143 m	95 km/hr	96	13	97	14
Diesel passenger train	26 m	95 km/hr	0	1	1	0
Freight train	650 m	65 km/hr	2	1	2	1

The noise modelling considered both day and night time investigation thresholds as defined by the PRINP.

The investigation threshold for average noise level is based on the noise generated by electric passenger, diesel passenger and freight train movements. The maximum noise level is based on the 95th percentile loudest noise generated by the same movements.

Noise levels (NV14, NV18)

Currently, the passenger and freight trains operate in an open rail line, with no specific noise or vibration attenuation. The lowering of the rail line into trenches would create a shielding effect, whereby some of the noise generated by the trains would be blocked by the walls of the trench.

The modelling shows that because of shielding of noise provided by the trench walls, passenger rail noise levels at the majority of receiver locations are generally reduced by around 5 dB(A). A 5dB reduction in noise is expected to be clearly noticeable to the human ear. The largest reduction in noise from passenger rail movements occurs at the deepest points of the trench, around Bonbeach and Edithvale stations.

Where freight locomotives are moving up the gradient to exit the trench, noise is increased because of the need for a higher locomotive notch (or throttle) setting. However, this effect does not meet the investigation thresholds in the PRINP.

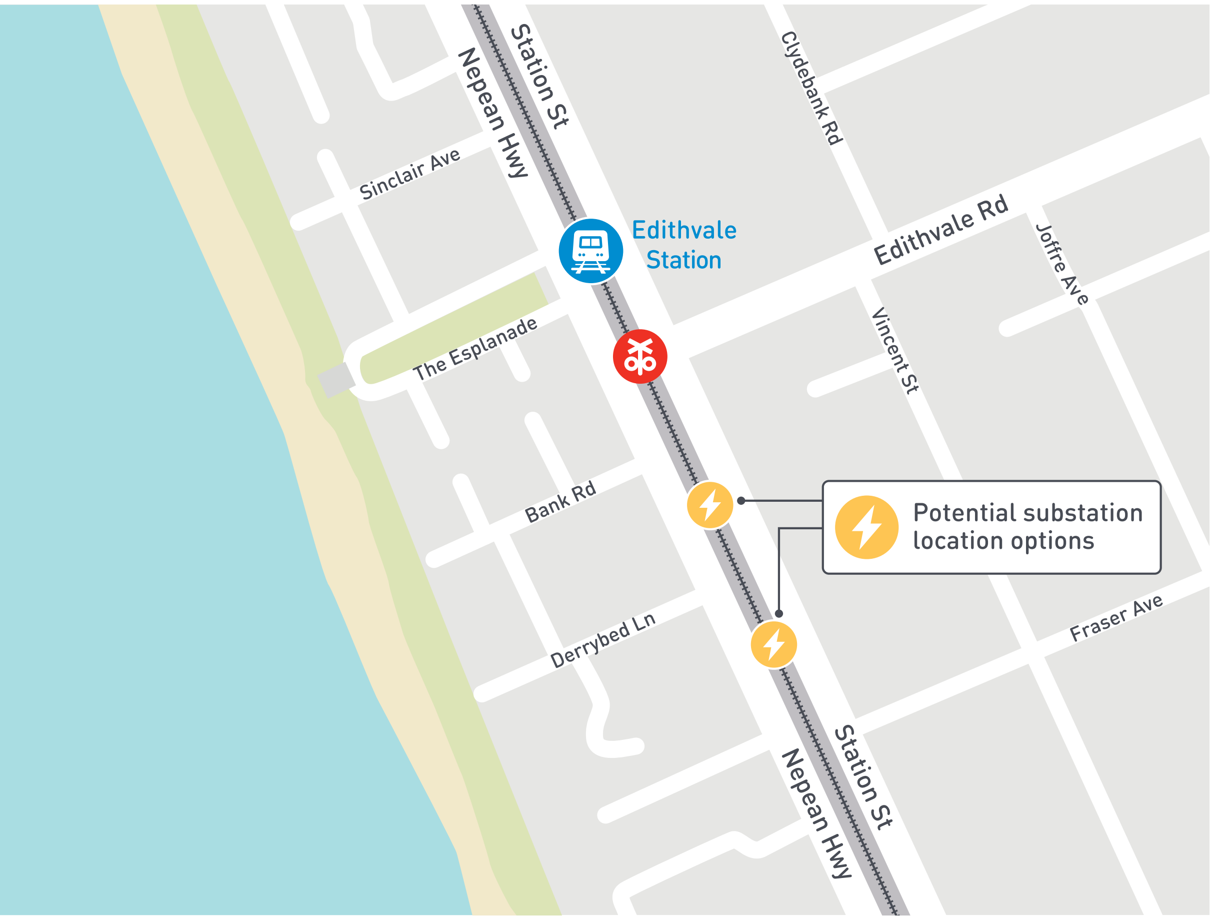
Refer to Technical Report H *Noise and Vibration* for a complete set of noise contours at both sites.

To summarise, the modelling shows that the PRINP thresholds would not be exceeded and that (EPR NV1) would be complied with. The projects would result in lower average noise levels compared to current levels because of the trench design and the removal of the level crossing warning signals. Therefore, the risk of noise levels exceeding the investigation levels in the PRINP and resulting in an impact to amenity at sensitive receptors due to noise is assessed as negligible.

Noise from stations and fixed rail infrastructure

Inert rail infrastructure associated with the rail line is required to comply with the Victorian State Environment Protection policy (SEPP N-1) limits. SEPP N-1, developed by the Environment Protection Authority (EPA) Victoria, prescribes procedures for determining the statutory environmental noise limits which apply at sensitive receptors. It aims to protect people from industry noise that may affect normal domestic and recreational activities, including sleep at night. The substation at Edithvale is required to comply with SEPP N-1. The substation could be located in one of two positions as seen in Figure 8.2.

Figure 8.2 Potential location of substation at Edithvale



Noise limits are calculated by taking into account existing background noise levels, and the type of area in which the sensitive receptor is located. The design of the substation would ensure that any noise generated by the substation is under the SEPP N-1 noise limit.

Additionally, the stations at Bonbeach and Edithvale would need to achieve the SEPP N-1 noise limit. The primary source of noise from the station would be from the public address (PA) system. The PA system will be designed to ensure that noise emissions achieve compliance with SEPP N-1 limits.

Vibration (risk NV20)

Vibration is affected by the distance between the source and the receptor. As the railway corridor would not be any closer to sensitive receptors than is currently the case, operational vibration levels are not expected to be different from existing conditions. At distances greater than 15 metres from the rail line, vibration levels are predicted to be below the levels likely to cause an impact on nearby residents and receptors. Therefore, the risk of vibration levels exceeding the criteria and resulting in a loss of amenity would be negligible.

8.3 Traffic

The safe and efficient operation of the road network is a key factor in how the community moves through and uses its neighbourhood. The removal of the level crossings at Edithvale and Bonbeach would improve transport options in the area by providing safe east-to-west access across the railway line for all modes of transport, including pedestrians. Currently, traffic disruption is experienced across a wider area than the immediate surrounds of the project areas, with boom gates down at Edithvale for an average of 42 minutes during the weekday morning peak, and 45 minutes at Bonbeach.

During construction, it is important to understand potential transport impacts so that they can be appropriately managed and do not result in unacceptable impacts to the community and businesses. Such impacts would be temporary and could include increased road congestion and delays, restricted access and mobility across the rail corridor, longer travel times and increased crashes.

Understanding the likely changes resulting from the projects is also important to inform the community and stakeholders about the proposed design and how the transport network would function on completion of the works.

A traffic impact assessment has been prepared and is provided in Technical Report G *Traffic*. This section summarises the outcomes of the assessment of impacts during construction and following completion of the Edithvale and Bonbeach level crossing removal projects.

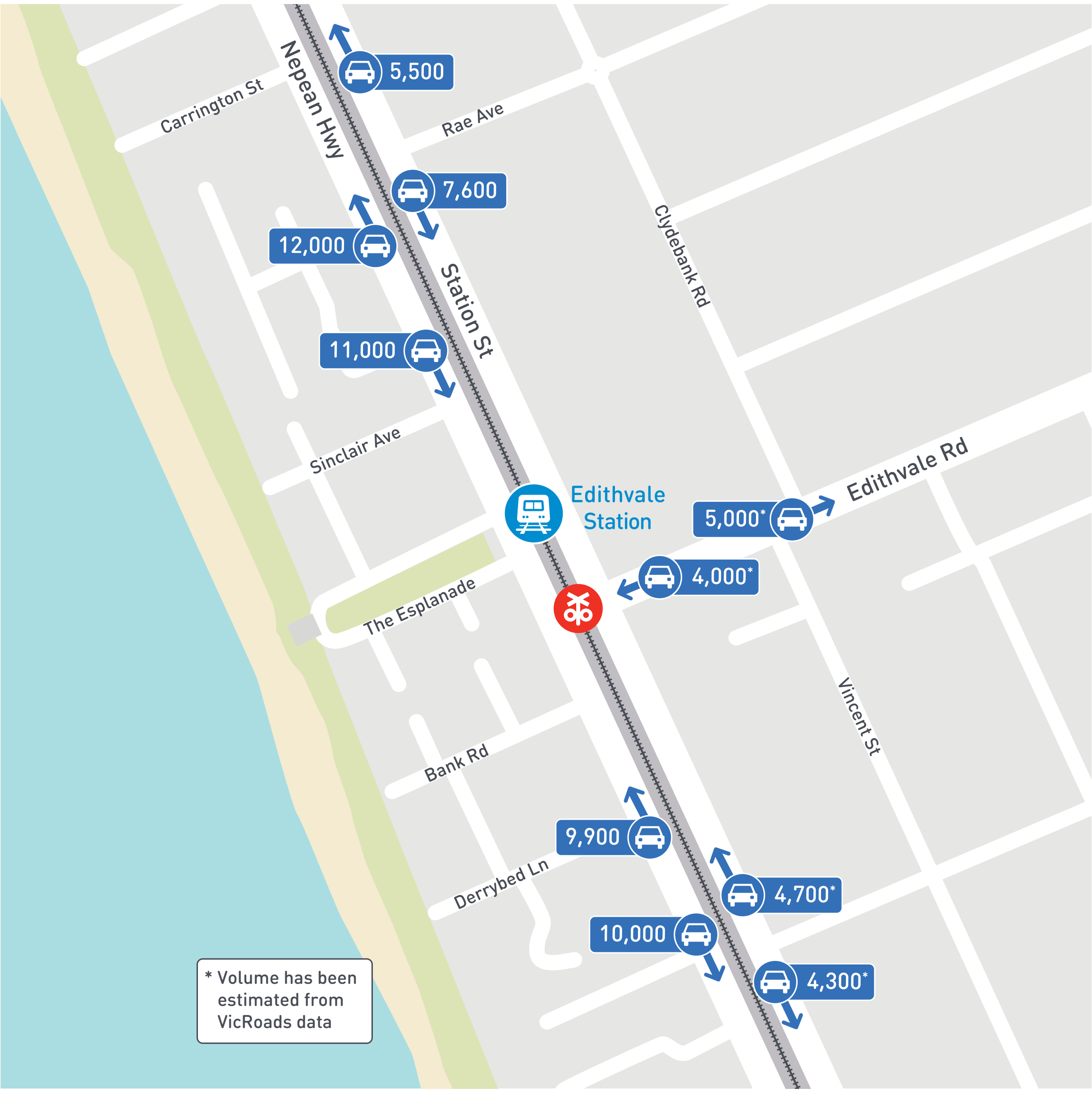
8.3.1 Existing conditions

Edithvale

The Edithvale Road level crossing is located at the end of Edithvale Road between Station Street and Nepean Highway. Nepean Highway is classified as an arterial road under the management of VicRoads and is a key north-south route in the bayside suburban road network. Station Street is a local road under the management of Kingston City Council that provides a localised movement and access function. Edithvale Road is the extension of Springvale Road and connects the beachside suburbs between Mordialloc and Patterson River to the Mornington Peninsula Freeway and suburbs to the north and east.

The estimated Annual Average Daily Traffic (number of vehicles per day) for Nepean Highway, Station Street and Edithvale Road is shown in Figure 8.3.

Figure 8.3 Annual Average Daily Traffic – Edithvale



Traffic data indicates that morning and afternoon peak hour traffic volumes on Nepean Highway, Station Street and Edithvale Road near the level crossing are less than the typical capacity for this type of road (which is considered an urban road with interrupted flow).

Site observations found that vehicles travelling through the Nepean Highway, Station Street and Edithvale Road intersections are subject to delays under the current operation of the intersections and boom gates. Traffic signal data indicates the boom gates are down for an average of 42 minutes during the weekday morning peak between 7-9am. The duration of boom gate closures invites risk-taking behaviour from road users trying to 'beat' the red lights and boom gates to avoid lengthy waits. This behaviour is likely to compound as population growth places further demand on the road and rail networks.

At Edithvale, long queues were seen during traffic observations, however each approach to the intersections cleared almost every time after the boom gates were raised apart from the north approach on Nepean Highway.

Statistics provided by Transport Safety Victoria and the Office of the National Rail Safety Regulator for the Edithvale level crossing indicate that in the 10-year period ending on the 31 December 2014 there was one fatal collision between a train and road vehicle and seven near miss incidents between a train and pedestrian. Statistics taken from VicRoads' Crashstats database for the same period indicate that there were 11 casualty crashes that did not involve a train, recorded within 20 metres of the level crossing on Edithvale Road.

Three bus routes (numbers 706, 858 and 902) travel along Station Street, however none use the level crossing. The 858 and 902 bus routes also use Edithvale Road.

Station Street is a Strategic Cycling Corridor (corridors designated to improve cycling to and around major activity centres) and existing Principal Bicycle Network route (a network of existing and proposed cycle routes identified to help people ride to major destinations). Edithvale Road is also an existing Principal Bicycle Network route. Cyclist counts were also undertaken for the project. Cyclist volumes on a weekday were relatively evenly spread between Nepean Highway and Station Street with a very low number of cyclists using Edithvale Road. Cyclist numbers on Station Street and Nepean Highway increase significantly on weekends.

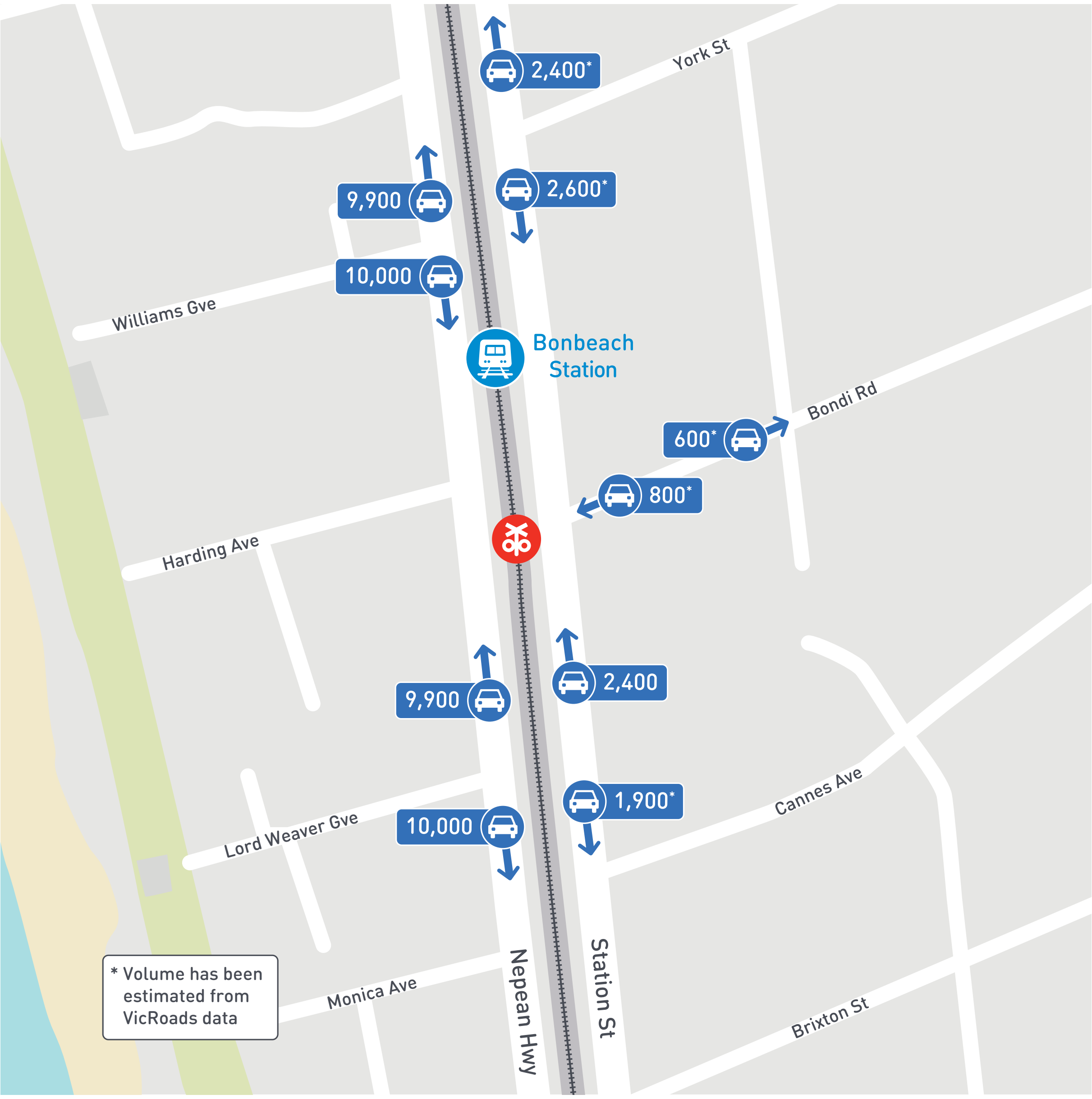
Pedestrian counts were undertaken for formal (i.e. signalised) and informal crossing points at Edithvale. The results show that the Station Street pedestrian crossing has significantly higher pedestrian volumes than the crossing of Nepean Highway.

Bonbeach

The Station Street level crossing at Bonbeach is located at the intersection of Nepean Highway, Station Street and Bondi Road. The designation and function of Nepean Highway and Station Street are as discussed above for Edithvale. Bondi Road is a local road that serves as an access to residential land use and sporting facilities.

The estimated Annual Average Daily Traffic (number of vehicles per day) for Nepean Highway, Station Street and Bondi Road is shown in Figure 8.4 below.

Figure 8.4 Annual Average Daily Traffic – Bonbeach



* Volume has been estimated from VicRoads data

Traffic data indicates that morning and afternoon peak-hour traffic volumes on Nepean Highway, Station Street and Bondi Road near the level crossing are less than the typical capacity for this type of road.

Traffic observations found that vehicles travelling through the Nepean Highway, Station Street and Bondi Road intersection are subject to delays under the current operation of the intersection and boom gates and in particular, those vehicles turning across the level crossing. Traffic signal data indicates the boom gates are down for an average of 45 minutes during the weekday morning peak between 7am and 9am. The duration of boom gate closures invites risk-taking behaviour from road users trying to 'beat' the red lights and boom gates to avoid lengthy waits. This behaviour is likely to compound as population growth places further demand on the road and rail networks.

Statistics provided by Transport Safety Victoria and the Office of the National Rail Safety Regulator for the Bonbeach level crossing indicate that in same 10-year period as referenced above there was one non-fatal collision incident between a train and road vehicle, three near miss incidents between a train and road vehicle and five near miss incidents between a train and pedestrian. Statistics taken from VicRoads' Crashstats database for the same period indicate that there were 16 casualty crashes that did not involve a train, recorded within 20 metres of the Station Street / Bondi Road level crossing.

There are no bus routes on this section of Nepean Highway or Station Street.

Nepean Highway is a Strategic Cycling Corridor and existing Principal Bicycle Network route in the area of the level crossing. A cyclist count during the week at Bonbeach found that cyclist volumes are evenly spread across Nepean Highway and Station Street, although there is an early southbound movement on Nepean Highway.

Pedestrian counts were undertaken for formal (i.e. signalised) and informal crossing points at Bonbeach. The results show that the Station Street pedestrian crossing has significantly higher pedestrian volumes than the crossing of Nepean Highway. Surveys of informal crossing locations indicated most pedestrian traffic was to and from the station from parking on the western side of Station Street.

8.3.2 Construction impact assessment

The traffic risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.9.

Table 8.9 Traffic and transport risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual risk
T28	Traffic (delay during main works)	Construction (including rail shutdowns) reduces road capacity and/or increases traffic volumes resulting in delays and increased travel time during the piling and main rail occupation.	EPR T1 Transport Management Plan EPR T2 Public Transport Disruption Management Plan EPR T3 Pedestrian and cyclist connectivity EPR T8 Emergency services	Moderate
T29	Traffic (delay outside main works)	Construction (including rail shutdowns) reduces road capacity and/or increases traffic volumes resulting in delays and increased travel time outside the piling and main rail occupation.	EPR T1 Transport Management Plan EPR T2 Public Transport Disruption Management Plan EPR T3 Pedestrian and cyclist connectivity EPR T8 Emergency services	Minor

Risk ID	Risk name	Risk pathway	Final EPR	Residual risk
T30	Traffic (dirt on roads)	Plant and spoil trucks deposit construction debris on public roads leading to dust generation, perceived loss of amenity and public health and safety issues.	EPR T7 Debris on roads	Negligible
T31	Traffic (road safety)	Construction results in disruption to the transport network and/or increases in traffic volumes leading to increased crashes or the perception that the area is less safe.	EPR T1 Transport Management Plan	Minor

Construction traffic and road safety (risk T28, T29, T31)

Implementing significant transport infrastructure projects (such as level crossing removals) in constrained urban areas often results in a level of disruption to access and mobility. Work during the construction phase of the level crossing removal projects has the potential to impact traffic operations and road safety. Aspects of construction that have been identified as having the greatest potential to result in impacts include:

- construction traffic
- lane closures (vehicle and bicycle lanes) and parking removal
- road closures
- rail line closures
- pedestrian crossing and footpath closures.

The types of vehicular trips associated with demolition and construction activities include heavy vehicles bringing machinery to site, mobile plant travelling to site, workers travelling to site, delivery of materials, and removal of excavated spoil and debris.

During the first half of the main occupation the number of vehicle movements to each site is expected to peak between 1300 and 1600 vehicles per day (2600 to 3200 trips total including those both to and from site). This includes vehicles of all types, with approximately 1000 trucks a day removing spoil and 300 staff vehicles travelling from the construction compounds to site. For the remainder of the occupation the number of vehicle movements to each site is expected to be between 400 and 600 per day (800 to 1200 trips total) comprising of workforce, supervisors and material deliveries.

The temporary construction areas would also generate traffic as a result of construction workers traveling to work and deliveries made to the areas. During the first half of the main occupation about 150 to 250 vehicle movements are expected to each sites' temporary construction areas by construction workers travelling to work each day. The same number of movements is expected in the reverse direction when workers travel home. The number of workers travelling to and from site is expected to be lower outside the main occupation.

The total number of vehicle movements to the construction compounds would depend on how the delivery of materials and plant to site is managed. If the temporary construction areas are used as staging points for the delivery of materials to site (other than them being delivered directly to site) and the delivery vehicles do not use the roads between the site and construction compounds, the total number of construction vehicle movements on key roads near the works should be unchanged.

While construction laydown areas have not yet been identified, vehicle movements between those and the project areas would be determined prior to the construction phase in consultation with Kingston City Council and VicRoads. It is anticipated that these movements would preferably use arterial roads where possible. Some use of Station Street may be unavoidable, and hence it has been included in this assessment. The potential construction vehicle routes for Edithvale and Bonbeach can be seen in Figure 8.5.

Figure 8.5 Part A: Potential construction routes for Edithvale

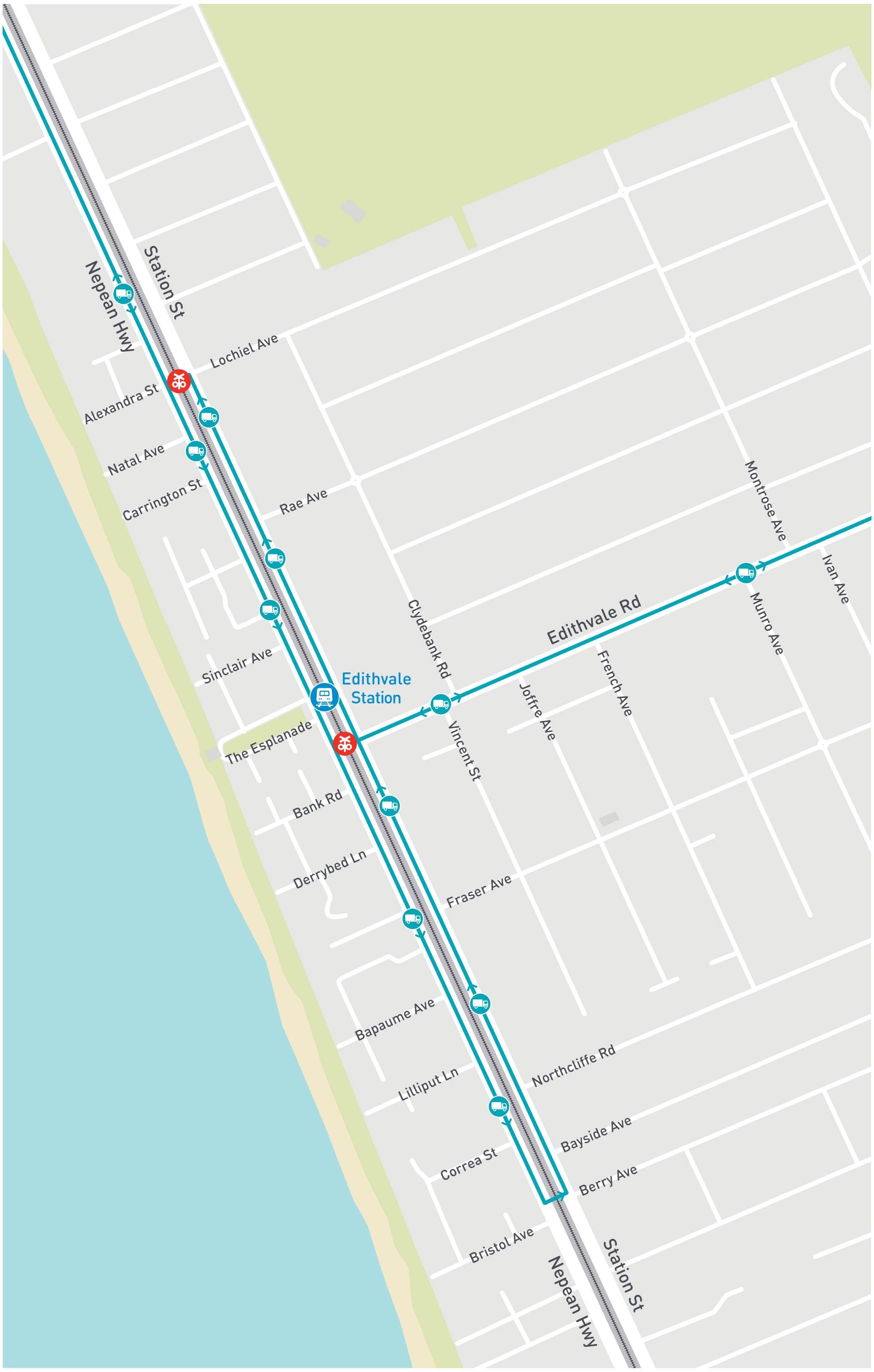
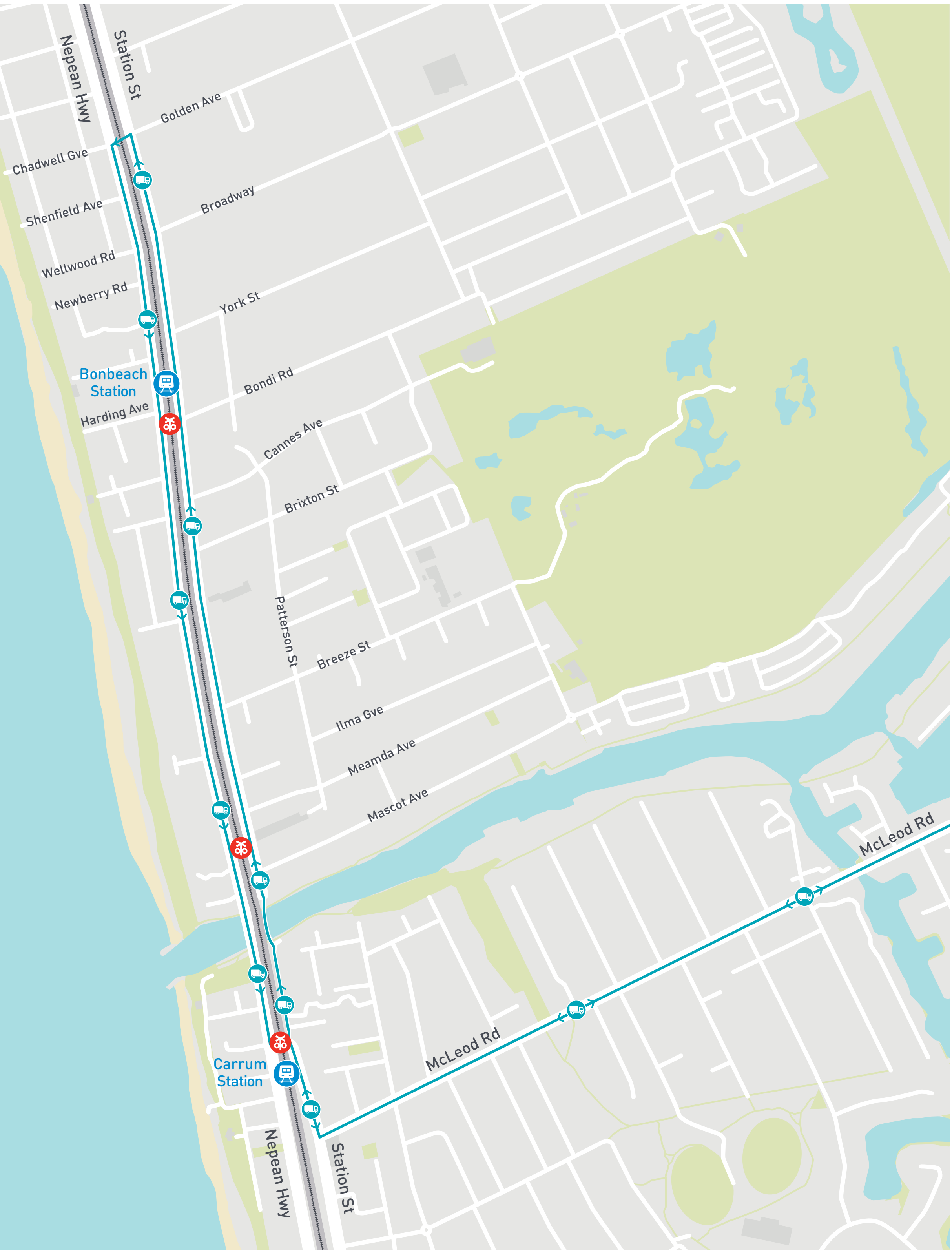


Figure 8.5 Part B: Potential construction routes for Bonbeach



The risk levels are therefore reflective of the uncertainty of how the traffic will behave during this time. Construction traffic during the main works period is expected to result in an overall increase in traffic in proximity to the construction sites, however a number of factors could impact the road network including:

- the completion of the bridge connecting Station Street over Patterson River prior to the commencement of works at Edithvale and Bonbeach, providing an additional alternate route for north-south traffic
- the type of traffic management required on Nepean Highway and Station Street during the main occupation (temporary lane closures or temporary lane realignments)
- temporary road closures and associated diversions
- a shift in travel mode due to rail line closures (for example, train users may prefer to drive during this time)

Road users may seek alternative routes or avoid the area. Outside of the main works, increases to traffic volumes are expected to be less apparent because of the lower volume of construction traffic.

To facilitate construction activities for both projects it is expected that lane closures (either full or partial), including cycle lanes (where present), would be required on Nepean Highway and Station Street at times during the works. Lane closures or part lane closures are anticipated for southbound through and turning lanes on Nepean Highway (including indented parking) and northbound traffic and cycle lanes on Station Street (including indented parking bays). Reducing Nepean Highway to a single lane of traffic travelling southbound during the afternoon peak while maintaining current traffic levels would likely exceed the capacity of one lane. This would result in increased queueing and delays, which would be further exacerbated by the increased traffic from construction. During off peak times, congestion would still be expected, however the level of impact would be lessened due to traffic volumes being lower.

Road closures are expected to be required at times during the works to facilitate construction activities for both projects including piling and abutment works as well as during the main occupation. Road closures are anticipated to be required on Edithvale Road between Nepean Highway and Station Street, and in Bonbeach at Station Street between Nepean Highway and Bondi Road. The intersections of Station Street and Edithvale Road and Station Street and Bondi Road may also need to be partially or fully closed at times. Road closures would increase traffic along detour routes but may not exceed the mid-block capacity of these roads.

To allow for construction it is expected that the Frankston rail line will be closed at times between Mordialloc and Frankston. This is because the construction site is highly constrained and the removal of the level crossings and construction of new stations cannot occur while trains are operating. The rail line is expected to be closed for six weeks during the main occupation period and at other times (for a shorter duration) during the construction period as required, usually overnight or during weekends. It is common practice to run rail replacement buses during rail line closures, however this can result in a longer travel time for commuters as the buses operate on the road and are therefore subject to traffic congestion and delays. It could also result in more people choosing to use their cars over the bus replacement service which could further exacerbate traffic congestion and delays.

There would also be a number of pedestrian crossing and footpath closures required during the construction period. This has the potential to increase travel distances and therefore result in longer journey times for pedestrians. Pedestrian crossing and footpath closures have the potential to impact safety if alternate facilities cannot be provided to the same standard or if the closures encourage pedestrians to adopt risky behaviour.

The risk that construction activities would result in traffic delays and increased travel times outside of the period when the piling works and main rail occupation occurs has been assessed as minor. During the piling works and main rail occupation period there is anticipated to be a higher level of traffic delays and associated impacts, and as a result this has been assessed as a moderate risk level. The risk that construction results in increased crashes or the perception that the area is less safe has been assessed as a minor risk level. These risk levels would be achieved through the implementation of a range of management and mitigation measures such as those outlined further below. These measures would be documented in a Transport Management Plan developed in consultation with, and to the satisfaction of, relevant road management authorities (EPR reference T1).

The Transport Management Plan would establish measures designed to minimise disruption to affected users and stakeholders. While the development of the plan is closely linked to the adopted construction methodology and would therefore be prepared by the project Alliance, the types of measures that would be considered include:

- rail replacement bus services during the rail line closures, including investigating the possibility of running two types of rail replacement services – one 'stopping all stations' and one running express to serve the needs of different users
- provision of alternative parking spaces for public and commuter parking and construction-related parking, the location of these will be dependent on the proposed construction methodology
- identification of routes for construction vehicles travelling to and from the construction site, minimising the use of local streets where practicable and promoting the use of arterial roads and higher order local roads (where necessary, for example Station Street)
- temporary signalisation at intersections identified as detour routes (where signalisation does not currently exist) and/or upgrades to detour routes where required
- implementation of a communications strategy, including extensive use of Variable Message Signs and local alerts, to advise affected users, potentially affected users, relevant stakeholders and the relevant road authorities of any changes to transport conditions to allow the community to plan ahead
- management of any road closures, including provision of diversion routes for vehicles, cyclists and pedestrians to maintain connectivity
- maximise the capacity (the amount of traffic that can be carried) of Nepean Highway and Edithvale Road during peak periods
- timing lane and road closures, oversized load deliveries and pedestrian disruptions to minimise impacts (for example, at times when traffic volumes are lower, avoiding the weekday peak period or weekends during summer when the number of beachgoers will be higher).

These measures would be developed with safety of traffic, pedestrians and cyclists during the construction period as a key guiding principle.

During construction the projects would also:

- maintain and enhance, where practicable, pedestrian and cyclist connectivity during construction (EPR reference T3) by providing, for example:
    - advance notification of works to encourage cyclists and pedestrians to seek alternate routes
    - traffic signal modifications to provide additional pedestrian crossing time
    - provision of temporary pedestrian crossings in close proximity to the existing crossings
    - the development and implementation of signed detour or diversion routes for pedestrians and cyclists
    - conducting particularly disruptive activities outside times where large volume of pedestrians are expected (such as the weekday peak period or during summer)
- reinstate vehicle and pedestrian access (EPR reference T6) as soon as possible after works are completed
- maintain access requirements for vehicles and pedestrians to emergency services at all times and, where practicable, to other key health and medical facilities, through consulting with relevant emergency services (EPR reference T8).

While the effective implementation of these measures would assist to provide for the efficient and safe operation of the transport network during construction, the unavoidable nature of this impact and the volume of construction traffic necessary to construct the projects is such that there would be residual impacts felt by the community. Residual traffic impacts associated with the construction period are expected to be greatest during the piling works and main rail occupation period and in morning and evening peak periods when existing traffic volumes and the demand for public transport travel are highest.

Amenity (risk T30)

Managing dirt and debris from being transferred to roads from construction activities would be undertaken by street sweeping, covering all truck loads and monitoring the surrounding road network to identify issues as they arise. Further measures that could be implemented if dirt and debris are causing issues within the surrounding community include the installation of vehicle washing facilities and/or rumble grids for vehicles exiting the construction site. This would mitigate the impacts of construction traffic from tracking dirt on public roads (EPR reference T7) and maintain a negligible risk rating for this issue.

8.3.3 Operation impact assessment

The traffic risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.10.

Table 8.10 Traffic risks – operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual risk
T26	Traffic (operations)	New road network layout and signalling may not adequately cater for the safe and efficient movement of traffic following level crossing removal, resulting in unacceptable intersection performance and/or increased crashes.	EPR T4 Intersection design and performance	Negligible
T27	Traffic (connectivity)	Connectivity for pedestrians and cyclists is negatively impacted by level crossing removal, resulting in increases to travel distance and/or time resulting in social and business impacts.	EPR T3 Pedestrian and cyclist connectivity EPR T6 Vehicle and pedestrian access	Negligible
T32	Traffic (change in AQ)	Changes in traffic flows at the level crossing results in air quality impacts.	EPR T4 Intersection design and performance	Negligible
T33	Traffic (change in noise)	Changes in traffic flows at the level crossing results in noise impacts.	EPR T4 Intersection design and performance	Negligible

Note that:

- Risk T32 is discussed in Section 8.7 in relation to air quality
- Risk T33 is discussed in Section 8.2 in relation to noise and vibration.

Traffic operations (risk T26)

Removal of the level crossings is expected to result in improved safety by removing the potential for conflict between trains and road users. This would benefit both current users of the road network and any future users who previously avoided the level crossings.

Removal of the level crossings would mean that rail and road-based transport would no longer interact at each level crossing site. As a result, the intersections would not need to cater for boom gates being down for 42 minutes and 45 minutes during the morning peak at Edithvale and Bonbeach respectively.

The removal of the trains from the intersections is therefore expected to improve the functionality and efficiency of the road network.

The traffic assessment for the projects recognises that each intersection is a small part of a complex transport network in the area that is affected by the interaction of pedestrians, cyclists, on-road public transport, trains and private vehicles. The assessment considers how the removal of the two level crossings would contribute to the overall road-based transport network, and concludes the intersections at both Edithvale Road and Station Street/Bondi Road are expected to have acceptable intersection performance following level crossing removal (EPR reference T4).

The removal of the level crossings would provide VicRoads with the opportunity to upgrade signal phasing and optimise intersection performance. Without the trains moving through the intersections, signal phases are able to run more frequently and can be allocated more or less cycle time as required in response to demand. This is expected to result in reduced delays and enhanced reliability for cross-rail corridor movements. Removal of the trains from the intersections would allow traffic signal cycle times to be allocated in a way that better balances the competing demands for movement from pedestrians, cyclists, public transport and general traffic.

While the project areas are highly constrained in terms of land availability for designing the new intersections, a range of traffic modelling and design tools have been used in consultation with road management authorities to inform the future intersection design to cater for the existing and predicted traffic (EPR reference T4). The design process would endeavour to provide spare capacity within the design to cater for traffic volumes higher than predicted.

Additionally, one of the key principles of the design process is to provide for safe vehicle movements. While the intersection layout and signal phasing of the intersection will be further refined in subsequent design stages by the project Alliance in consultation with VicRoads, modelling done as part of this EES indicates that the proposed modifications to the configuration of intersections can operate at an acceptable level of service.

The implementation of established intersection and signalling design principles and processes (including Safety in Design) is considered adequate to mitigate unacceptable impacts to traffic operations and road safety and therefore the residual risk is considered negligible.

Traffic connectivity (risk T27)

Changing the connections as a result of the projects could potentially restrict pedestrian and cyclist connectivity by removing existing pedestrian and cyclist crossings and informal pedestrian and cyclist crossing points and opportunities (i.e. when the boom gates are down). This could lead to an impact on pedestrian and cyclist connectivity and their subsequent use of the area. However, it should be noted that reducing the potential for informal and uncontrolled crossing of the railway or roads would increase safety by reducing the risk that a pedestrian is struck by a train or vehicle.

Upgrades to the road network would address substandard elements of the current road design (such as lane widths and merge distances) and may also assist to reduce the likelihood of crashes for pedestrian and cycle facilities through the intersections.

The projects would be designed and constructed to provide suitable routes for pedestrians and cyclists to maintain connectivity after construction (EPR reference T6). This would be through the provision of pedestrian bridges across the rail corridor, retention of existing pedestrian crossings at signalised intersections and provision of a north-south shared-use path on the western side of Station Street. Crossing points of the railway would be developed in consultation with the community and road management authorities (EPR reference T3). The projects may be able to improve pedestrian access across the railway if feedback from the community leads to improvements to the current crossing locations. This would reduce the likelihood of unacceptable impacts to pedestrian and cyclist connectivity resulting in increases to travel distance and journey time. The implementation of these controls is considered adequate to mitigate for unacceptable impacts, and therefore the residual risk is considered negligible.

8.4 Historic heritage

Historic heritage refers to built form and archaeological remains of buildings and places dating from after European settlement, as distinct from Aboriginal heritage which is discussed in Section 8.5.

Historic heritage provides a connection to the history and identity of a place. The appropriate management of heritage places ensures that the heritage value of the places, and their contribution to the local area, is conserved for present and future generations.

In Victoria, heritage places of state significance are recognised and protected through listing on the Victorian Heritage Register under the *Heritage Act 2017* (Heritage Act) and through Heritage Overlays in local planning schemes in accordance with the *Planning and Environment Act 1987* (P&E Act). Places of local heritage significance are identified and protected through Heritage Overlays. In addition, the Victorian Heritage Inventory (which is also administered under the Heritage Act) protects archaeological remains over 75 years in age.

The *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) protects places on the World Heritage List, National Heritage List and Commonwealth Heritage List Australia wide, including in Victoria.

Both direct and indirect risks to heritage associated with construction activities exist, particularly with respect to demolition or modification of heritage-listed buildings. Excavation works may also result in damage or destruction of archaeological sites. Newly constructed built-form may result in indirect impacts due to visual changes to the landscape character and setting of historic heritage places.

A historic heritage assessment has been prepared and is provided in Technical Report N *Historic heritage*. This section summarises the outcomes of the assessment for the Edithvale and Bonbeach level crossing removal projects.

8.4.1 Existing conditions

The Edithvale and Bonbeach project areas do not include, nor adjoin, any heritage places listed on the National Heritage List, Commonwealth Heritage List, Victorian Heritage Register or Victorian Heritage Inventory.

The existing Edithvale and Bonbeach railway stations are not identified as heritage places and their demolition would have no heritage impact.

The area to the west of the Edithvale project area comprises commercial buildings from the interwar and post-war periods. To the east are one- and two-storey residential properties. There is one site of local heritage significance (Chelsea Clock Tower, within Heritage Overlay 28, HO28, in the Kingston Planning Scheme) in the Edithvale project area; however, it is not within the construction area (refer to Figure 8.6 and Figure 8.8).

Located to the west of the Bonbeach project area are mid-to-late twentieth century commercial buildings. To the east of the project area are brick houses from the late twentieth century. One site of local heritage significance (Chelsea Railway Station, HO31) is located in the Bonbeach project area; however, it is not within the construction area (refer to Figure 8.7 and Figure 8.9).

In addition, there are a number of Heritage Overlay sites situated adjacent to, but outside, the project areas. These are shown in Figure 8.8 and Figure 8.9, and the potential effects of the projects on all heritage values discussed in this section are discussed in Section 8.4.2 and Section 8.4.3.

Figure 8.6 Chelsea clock tower

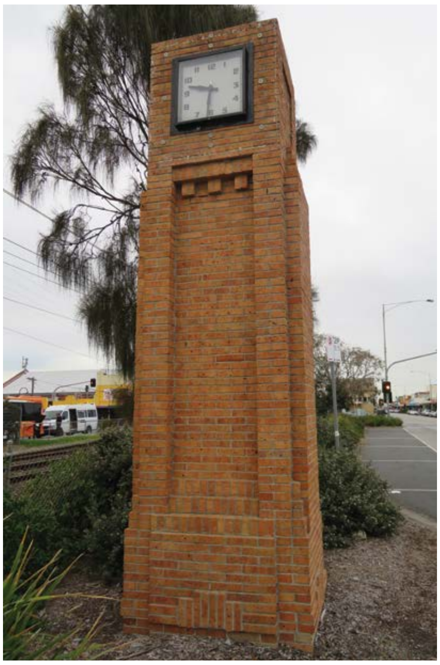


Figure 8.7 Chelsea Railway Station

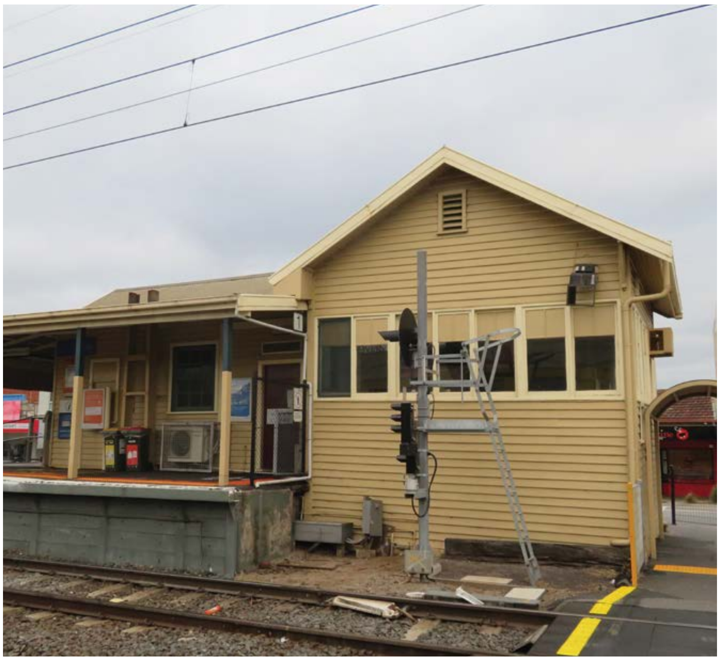


Figure 8.8 Heritage Overlay places in the vicinity of the Edithvale project area

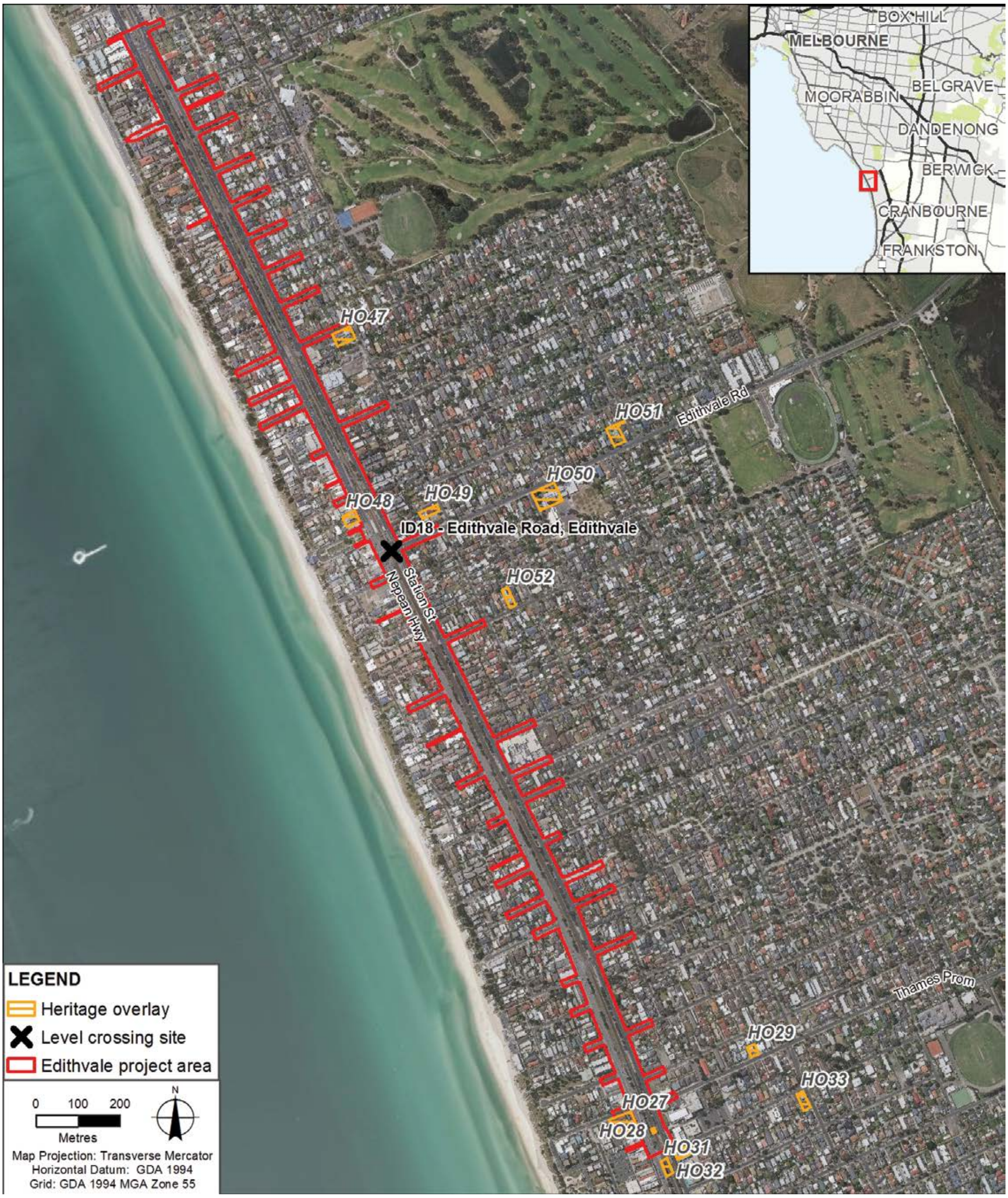
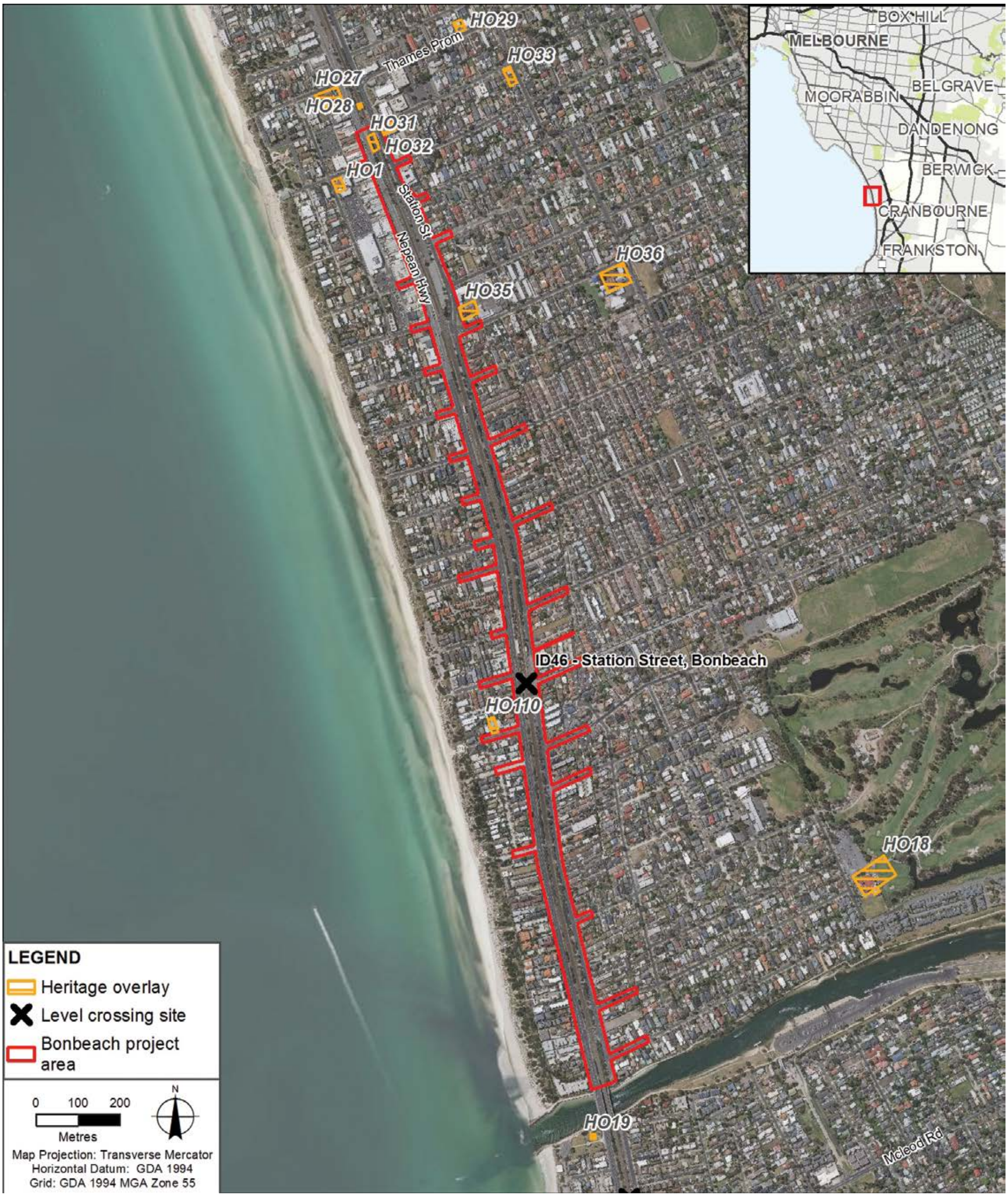


Figure 8.9 Heritage Overlay places in the vicinity of the Bonbeach project area



8.4.2 Construction impact assessment

The historic heritage risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.11.

Table 8.11 Historic heritage risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
HH4	Disturbance of identified historic heritage	Disturbance of identified historic heritage places (included in the Heritage Overlay) resulting in loss of heritage value	EPR HH2 Heritage overlay sites	Negligible
HH5	Disturbance of non-identified historic heritage	Disturbance of not previously identified historic heritage places and sites (archaeological places and sites not included in the Victorian Heritage Inventory) resulting in loss of heritage value	EPR HH1 Unidentified historical archaeological sites	Negligible

Disturbance of historic heritage (risks HH4 and HH5)

The construction activities within the project areas would have no impact on any heritage places of national or state significance. The two sites of local heritage value within the project areas – Chelsea Clock Tower (HO28) and Chelsea Railway Station (HO31) – are not within the footprint of the proposed infrastructure and associated works which would be undertaken such that there would be no impact to either site (EPR reference HH2).

Whilst there are no known archaeological sites listed on the Victorian Heritage Inventory within the project areas, there is potential for archaeological values to exist. Therefore, a protocol for managing previously unrecorded archaeological sites and remains discovered during construction works would be prepared prior to the commencement of works and in consultation with Heritage Victoria. The protocol would provide a process for addressing any archaeological remains which are uncovered and would set out a specific procedure for dealing with remains, including any requirement or procedure for obtaining consents (EPR reference HH1).

While the consequences of these risks would be moderate or minor respectively, they are considered unlikely to occur as a result of the removal of the level crossings. Implementing the EPRs and adopting appropriate management controls would further reduce the risk of impacting heritage values, and it is unlikely that there would be a loss of heritage values due to the projects. Therefore, the risk of disturbance of identified and non-identified historic heritage resulting in loss of heritage value during construction is negligible.

8.4.3 Operation impact assessment

One risk was identified in relation to historic heritage during the operation phase (i.e. due to the design of the projects) of the Edithvale and Bonbeach level crossing removal projects and is outlined in Table 8.12.

Table 8.12 Historic heritage risks – operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
HH6	Visual impact on historic heritage	Visual impact of new buildings and barriers along the length of trench to the setting of heritage places.	EPR HH3 Heritage values	Negligible

Visual impact on identified historic heritage (risk HH6)

The projects would construct new buildings and landscape elements such as barriers and screening, footbridges (and a substation at Edithvale). These elements would alter the streetscape setting of the heritage places that adjoin the project areas shown in Figure 8.8 and Figure 8.9.

The design of new buildings, barriers and screening would be in accordance with the Urban Design Guidelines (UDG) prepared for the projects, which would include reference to adjoining heritage places, their setting and significance. The projects would be designed in accordance with the UDG to avoid or minimise, as far as is practicable, adverse visual impacts on adjoining heritage places (EPR reference HH3) to create a well-defined identity and sense of place (refer to Attachment VII *Urban Design Guidelines – Edithvale* and Attachment VIII *Urban Design Guidelines – Bonbeach*).

These heritage places are already viewed in the context of a varied streetscape and therefore implementing the UDGs and EPRs, would reduce the risk of visually impacting heritage values as a result of the new infrastructure to negligible.

8.5 Aboriginal cultural heritage

Heritage is the relationship between people and their past. Aboriginal cultural heritage can include culturally or spiritually significant places for Aboriginal people. Archaeological evidence within the Melbourne metropolitan region suggests an extensive history of human occupation dating back at least 31,000 years.

During construction of the projects, there is the potential to impact known or previously unrecorded Aboriginal cultural heritage places and associated values as a result of ground disturbance. Once the projects are complete, there would be no risk to Aboriginal cultural heritage.

An Aboriginal cultural heritage impact assessment has been prepared and is provided in Technical Report M *Aboriginal cultural heritage*. This section summarises the outcomes of this assessment for the Edithvale and Bonbeach level crossing removal projects.

8.5.1 Existing conditions

Aboriginal cultural heritage in the vicinity of the Edithvale and Bonbeach project areas has been assessed by reviewing the project boundary's geographic and environmental context, an assessment of the historical environment, and review of relevant heritage databases.

There are no registered Aboriginal cultural heritage places within either of the Edithvale or Bonbeach project areas, which may be due in part to a combination of (among other factors) a lack of previous detailed investigations in the area and the level of ground disturbance and development since European settlement.

Within one kilometre of the combined project areas, there are two registered Aboriginal cultural heritage places, comprising of low density artefact distributions. These are located outside the southern extent of the Edithvale component of the Edithvale-Seaford Wetlands. This suggests that there may be potential for additional Aboriginal cultural heritage to exist in the area which would be investigated during the preparation of a Cultural Heritage Management Plan (CHMP) in accordance with the *Aboriginal Heritage Act 2006*. Should Aboriginal cultural heritage be identified during this process, it would be documented and listed on the Victorian Aboriginal Heritage Register prior to the commencement of works.

8.5.2 Construction impact assessment

The Aboriginal cultural heritage risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.13.

Table 8.13 Aboriginal cultural heritage risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
ACH1	Disturbance of known Aboriginal cultural heritage	Disturbance of previously registered Aboriginal cultural heritage places resulting in loss of heritage value	EPR AH1 Cultural Heritage Management Plan	Negligible
ACH2	Disturbance of unknown common Aboriginal cultural heritage	Disturbance of not previously registered common Aboriginal cultural heritage places resulting in loss of heritage value	EPR AH1 Cultural Heritage Management Plan	Negligible
ACH3	Disturbance of unknown rare Aboriginal cultural heritage	Disturbance of not previously registered rare Aboriginal cultural heritage places resulting in loss of heritage value	EPR AH1 Cultural Heritage Management Plan	Negligible

Disturbance of Aboriginal cultural heritage (risks ACH1, ACH2 and ACH3)

There are no currently registered Aboriginal cultural heritage places within the project areas; therefore it is unlikely that there would be a loss of heritage values during construction. While there are no previously recorded Aboriginal cultural heritage places within the project areas, there is potential for them to occur despite the high level of historic disturbance within the project areas. Unauthorised disturbance of Aboriginal cultural heritage places is a breach of the *Aboriginal Heritage Act 2006*, and the CHMP is a statutory approval that would contain measures that must be implemented to manage (i.e. collect, store and possibly repatriate) Aboriginal cultural material (including those identified and registered during the preparation of the CHMP). The CHMP also establishes contingency measures that must be implemented should previously unrecorded Aboriginal cultural heritage be encountered during works (EPR reference AH1).

More specifically, the CHMP would include measures that relate to:

- management of Aboriginal cultural heritage found during works
- custody and management of Aboriginal cultural heritage recovered
- management of the discovery of ancestral (human) remains
- review and compliance with the CHMP.

Implementing the CHMP and adopting the measures to protect and manage previously unrecorded Aboriginal cultural heritage places would result in a negligible risk. The projects' potential to impact the heritage value of unrecorded Aboriginal cultural heritage places would be unlikely, and obtaining an approved CHMP would manage the risk of encountering heritage and ensure that any impacts to Aboriginal heritage is lawful under the *Aboriginal Heritage Act 2006*.

8.6 Surface water

Modifying the characteristics of an urban stormwater catchment, through processes such as land use change and development, can have a significant impact on the nature of stormwater runoff. These changes could result in greater volumes of runoff and increased sources and loads of pollutants in runoff.

Stormwater runoff from construction areas and the completed trench would require management to prevent water quality or capacity issues.

A surface water impact assessment has been prepared and is provided in Technical Report E *Surface Water*. This section summarises the outcomes of the assessment of surface water impacts as a result of the Edithvale and Bonbeach level crossing removal projects.

Stormwater runoff

Stormwater runoff is rainfall that flows over the ground surface. It is created when rain falls on roads, other paved surfaces and already saturated soils that do not allow water to soak into the ground.

Runoff ends up in drains, nearby streams, rivers and ultimately, for these areas, in Port Phillip Bay.

Unmanaged runoff can erode watercourses as well as cause flooding after the stormwater collection system is overwhelmed by the additional flow. Runoff can also cause water pollution due to potential contaminants that the water is carrying.

8.6.1 Existing conditions

The Edithvale and Bonbeach project sites are located between the Nepean Highway and Station Street, both of which are flat. Run-off from land to the east of the rail corridor drains into the Centre Main Drain, which runs north-south along the western side of the Edithvale component of the Edithvale-Seaford Wetlands. Stormwater reaches the drain via overland flow or the underground stormwater system. The drain discharges stormwater collected north of Thames Promenade into Mordialloc Creek, and from south of Thames Promenade into the Patterson River, both via a stormwater pump station. Run-off from the western side of the rail corridor discharges to Port Phillip Bay.

There is no existing formal drainage network to capture stormwater from the rail corridor; because it sits higher than the adjacent land and is unsealed. Rainfall typically soaks into the soil and any excess run-off currently flows over the land onto the adjacent roadside drains and into the Council stormwater networks. Given its elevation, the rail corridor is not subject to flooding.

Given the low-lying and flat topography of the Edithvale and Bonbeach areas, the majority of local drainage assets already operate at capacity which results in frequent flooding of local streets and low-lying areas.

8.6.2 Construction impact assessment

The identified risks for the surface water environment associated with the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.14.

Table 8.14 Surface water risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
SW22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding	EPR SW3 Drainage network – construction EPR SW5 Flood protection – construction	Negligible
SW23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW1 Stormwater management – construction	Negligible
SW24	Stormwater runoff	Stormwater runoff is above SEPP limits and enters receiving water bodies.	EPR SW1 Stormwater management – construction	Negligible

Disposal of runoff (risk SW22)

Rain water that collects in the trench during construction would require 'dewatering', that is, appropriate management and disposal to prevent flooding and enable construction to continue. This would occur through the use of temporary pumps which would transfer the water to a dedicated discharge point.

It is acknowledged that the existing local drainage infrastructure has limited additional capacity to cater for stormwater to be discharged from the trench if the network is still conveying surface runoff (i.e. during rainfall events).

If stormwater from the trench is to be discharged to the local network, this would require approval from Kingston City Council and would need to meet EPA water quality requirements (see water quality below). The water would need to be discharged in a controlled manner (i.e. after the rainfall event) so that it does not exceed the capacity of the local drainage network or increase surrounding flood levels (EPR references SW3 and SW5). To achieve this, the projects would have the following options:

- Implement on-site water storage in the form of a large tank or retarding basin.
- Construction works in the flooded sections of the trench may be delayed until the water can be removed from the trench without exceeding the capacity of the surrounding drainage infrastructure.
- A temporary discharge point could be provided or water could be pumped to a water truck and carted away. Disposal of carted water would be in accordance with EPA requirements.

By implementing the above controls, dewatering of the trench following a storm is unlikely to reduce the capacity of the local stormwater infrastructure and result in flooding. Therefore, the risk of the impact would be negligible.

Water quality (risks SW23 – SW24)

Runoff from stockpiled material and areas of exposed soil, including within the trenches during construction, has the potential to transport sediment or pollutants to the local drainage network and adversely impact water quality within receiving waters. Receiving waters potentially include Patterson River via the Centre Main Drain, and Mordialloc Creek.

Rain water would be removed from the trench and managed in accordance with EPA Victoria's Publication *480 Environmental Guidelines for Major Construction Sites* and State Environment Protection Policy (Waters of Victoria) (EPR reference SW1) to ensure discharges to stormwater do not exceed 30 NTU (NTU is a measure of the amount of sediment in water). This could be achieved through visual observation and/or testing. Stormwater runoff would also be managed in accordance with EPA Victoria's Publication *480 Environmental Guidelines for Major Construction Sites* (EPR reference SW1) to minimise the potential for impacts to water quality.

Compliance with EPA requirements and the relevant EPRs could be achieved through minimising the generation of waste water and diverting external overland surface water flows from the excavated area. Other measures may include:

- minimise the extent and duration the areas are disturbed (or cleared)
- provision for a sediment basin to allow course material to settle out
- monitoring of pumped water quality
- minimising volume and area of stockpiled material
- minimising the time construction materials are stockpiled.

If stockpiling of material excavated from the trench is required, measures to minimise impacts to stormwater quality include:

- bunding or silt fences to trap sediment
- using gradual slopes to prevent runoff or movement of material.

The implemented Construction Environmental Management Plan (CEMP) would specify measures to characterise, treat and dispose of potentially contaminated runoff (EPR reference EMF2).

With the implementation of these controls, stormwater runoff is unlikely to exceed the SEPP (Waters of Victoria) limits during construction. Therefore, the risk of stormwater entering Patterson River and Port Phillip Bay above the SEPP (Waters of Victoria) limits during construction of the projects would be negligible.

8.6.3 Operation impact assessment

The surface water risks identified for the operation of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.15.

Table 8.15 Surface water risks – operation

Risk ID	Risk name	Risk pathway	Final EPR	Risk level
SW22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding	EPR SW4 Drainage network – operation EPR SW6 Flood protection – operation	Negligible
SW23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW2 Water quality – operation	Negligible

Hydraulic capacity (risk SW22)

Stormwater that currently falls on the rail corridor infiltrates directly into the soil with little run-off to the surrounding drainage network. Construction of a concrete lined trench would prevent this infiltration and as a result, there would be a small increase in the overall volume of stormwater that requires management.

Discharging collected stormwater directly and immediately to the existing network without appropriate management and mitigation measures could potentially result in additional surface flows and increased flood levels. Due to the limited capacities within the stormwater drainage system surrounding the sites, surface water discharges from each project would therefore be required to have no adverse impact to the drainage network (EPR reference SW4). The projects would also be required to be designed to comply with the relevant approval authority requirements for flooding and overland flows (EPR reference SW6).

To manage the risk of increased flooding and comply with the EPRs (EPR references SW4 and SW6), there are a range of potential options that could be implemented:

- an alternative outfall to Centre Main Drain could be installed
- a rising main could be installed along the rail alignment to discharge to Patterson River
- the two-hour water storage tank beneath the rail trench could be used to hold runoff in a storm and manage flow rates into the existing stormwater system. The water storage facility would be designed to accommodate rainfall equivalent to a one in 100-year two-hour storm including an allowance for the climate change scenario discussed in Chapter 10 Sustainability and climate change
- liaise with Kingston City Council to develop a stormwater strategy.

With the implementation of one of the above stormwater management approaches and compliance with relevant approval authority requirements for flooding and overland flows, the risk the projects pose to flood risk and surface water would be negligible.

Water quality (risk SW23)

Collected stormwater runoff from the rail corridor has the potential to affect water quality at the receiving waterbody. To prevent such impacts, stormwater would be treated to meet the requirements of the relevant authority (i.e. SEPP Waters of Victoria and its discharge limits for receiving environments) (EPR reference SW2). The potential pollutants in the runoff would be reduced in accordance with the *Victorian Stormwater Committee's Best Practice Environmental Management Guidelines* (CSIRO, 1999). This would require the implementation of a water quality treatment strategy to remove the pollutants and satisfy water quality targets.

Options for water treatment include water sensitive urban design (WSUD) and integrated urban water management. This may include the installation or use of measures such as a bio-filter to treat stormwater prior to discharge. Bio-filters would be placed between the trench outfall and the local drainage network and filled with a porous filter material and planted with vegetation. Bio-filters have the effect of removing pollutants from stormwater runoff by using natural and physical processes from the porous material and vegetation to treat the stormwater. The inclusion or utilisation of a WSUD treatment would result in a net water quality benefit from the projects, as water currently discharges from this section of rail untreated.

Implementing the EPRs and adopting WSUD, such as bio-filters to remove pollutants from stormwater runoff, would reduce the risk to negligible. Stormwater would be treated to meet the SEPP (Waters of Victoria) discharge limits. Therefore, it is unlikely that dewatering of trenches following a storm would result in stormwater above the SEPP (Water of Victoria) limits being pumped to Patterson River, Mordialloc Creek and Port Phillip Bay.

8.7 Air quality

Air quality is a measure of the suitability of air for humans and for the physical environment such as plants and animals. In Victoria, air quality is regulated under the *State Environment Protection Policy (Ambient Air Quality)* (SEPP AAQ) and *SEPP (Air Quality Management)* (SEPP AQM).

SEPP (AQM) sets air quality policy for the state of Victoria to ensure that the environmental quality objectives of SEPP (AAQ) are met. Ambient air quality is measured, in part, by the levels of particulates, carbon monoxide, sulphur dioxide and nitrogen dioxide in the air environment. SEPP (AQM) has set intervention levels based on potential health impacts on sensitive receptors and adopted from the *National Environment Protection Measure* (NEPM). NEPM is a legal instrument specifying national standards for a variety of environmental issues, including air quality. For ambient monitoring purposes, standards and goals are set in SEPP (AAQ). When assessed or monitored levels exceed the intervention levels in SEPP (AQM), the projects are then required to develop an environmental management plan in order to minimise, manage or mitigate any impacts to air quality.

Changes in air quality may arise from construction activities such as site clearance, ground excavations and the exposure of contaminated soils, which each have the potential to generate amenity impacts from dust, odours and other emissions. Resultant changes in air quality also have the potential to affect the beneficial uses of the air environment, including human health as a result of aggravating existing respiratory diseases such as asthma and bronchitis, or increase the risk of respiratory problems.

Air quality may also be affected after the removal of the level crossings. By lowering the rail line into a trench, air emissions from freight trains would be dispersed differently from a trench relative to the current above-ground situation. Changes to traffic flows from the removal of the level crossings in the local areas could also result in localised changes, positive or negative, to air quality from vehicle emissions.

An air quality impact assessment has been prepared and is provided in Technical Report I *Air quality*. This assessment identifies potential air quality risks and how to manage or mitigate them. This section summarises the outcomes of the air quality assessment for the Edithvale and Bonbeach level crossing removal projects.

8.7.1 Existing conditions

The existing air quality at and around the Edithvale and Bonbeach project areas is typical of the Melbourne metropolitan air environment. The project areas are on the interface between the urbanised metropolitan area and the generally pollutant-free Port Phillip Bay. Being close to the Bay means that existing air quality is higher than average for Melbourne because coastal areas are subject to weather conditions that cause the dispersal of pollutants in the air more readily. Existing air quality is shown in Figure 8.10.

Ambient air quality levels are measured at EPA Air Quality Monitoring Stations, with the two closest and most indicative at Brighton and Dandenong. The measured ambient air quality indicators at these locations, and therefore by extrapolation at Edithvale and Bonbeach, were well below the air criteria limits of SEPP (AQM) and the NEPM. The monitoring stations showed that:

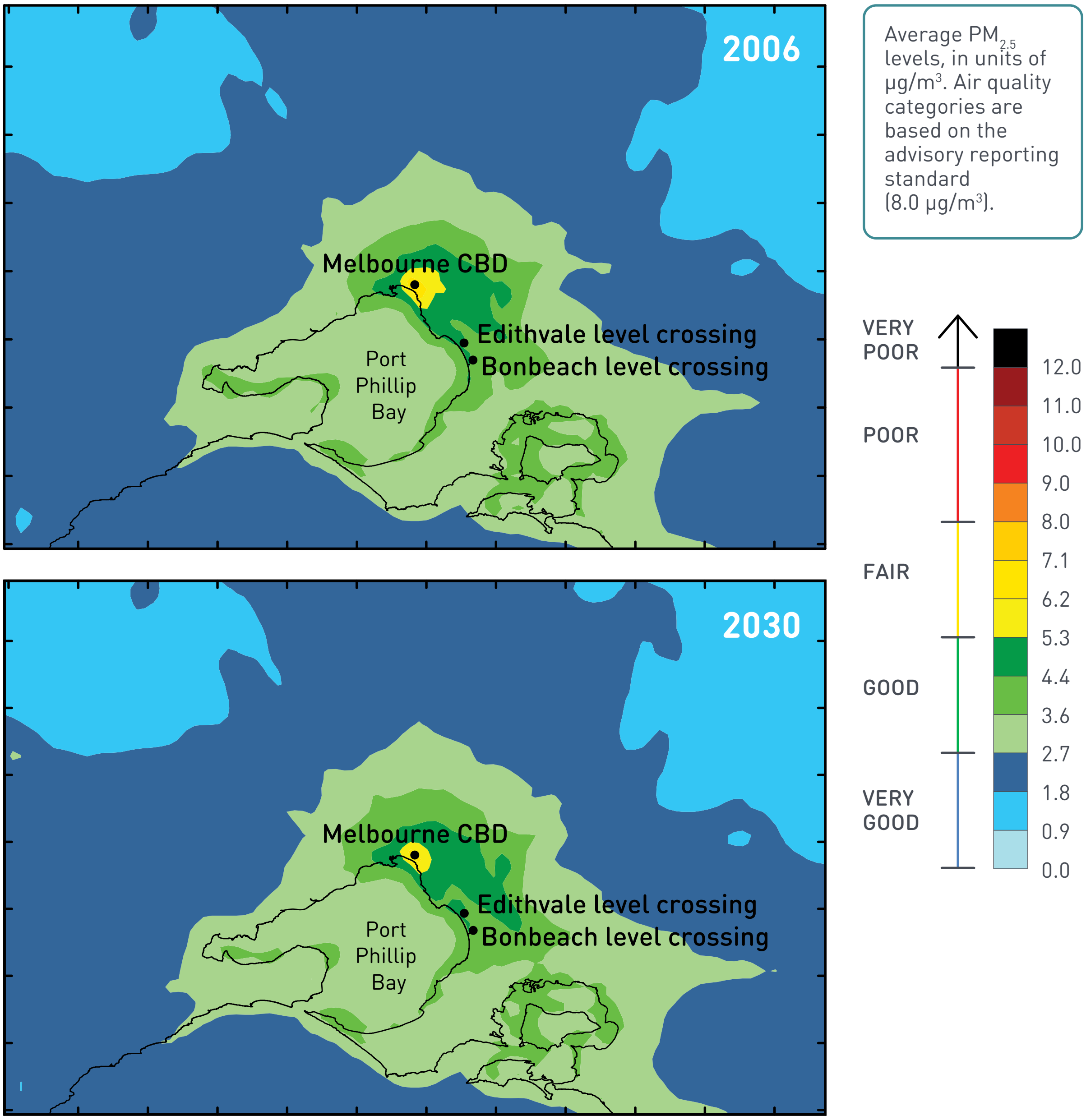
- the NEPM objectives for air quality were met for carbon monoxide, sulphur dioxide and nitrogen dioxide
- the annual particulate matter of 10 micrometres or less in diameter was approximately 60 per cent lower than the level where particulate matter would become a concern.

Why have EPA Air Quality Monitoring Stations at Brighton and Dandenong been used?

The Brighton and Dandenong Air Quality Monitoring Stations are part of a network of air quality monitoring stations across Victoria, providing population exposure levels to key air quality pollutants, as required by NEPM.

The Brighton and Dandenong stations provide a guide to air quality and potential health impacts across the whole south-east region of Greater Melbourne, including the Edithvale and Bonbeach areas.

Figure 8.10 Existing air quality



The operation of diesel trains impacts air quality from the emissions associated with the combustion of diesel fuel. On the Frankston rail line there are six diesel freight train movements on weekdays and four on weekends. Two diesel V/Line trains operate every weekday.

The air quality impact assessment identified a number of sensitive receptors for the Edithvale and Bonbeach level crossing removal projects. For the purpose of an air quality impact assessment, a sensitive receptor is defined as a site or area requiring a particular focus on protecting the air quality due to the sensitive nature of its use. These areas include hospitals, schools, residences and parks/open space in close proximity to the project areas. The closest sensitive receptors to the project areas are the residents located along Nepean Highway and Station Street.

8.7.2 Construction impact assessment

The air quality impacts identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.16.

Table 8.16 Air quality risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
AQ9	Air quality – dust (amenity)	Off-site dust levels results in perceived loss of amenity	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management	Negligible
AQ10	Air quality – dust (health)	Off-site dust levels above limits causes health impacts	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management	Negligible
AQ11	Air quality – plant combustion	Off-site NO_x, SO_x, CO, benzene, polycyclic aromatic hydrocarbons above SEPP (Air Quality Management) levels resulting in health impacts to sensitive receptors	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management	Negligible
AQ12	Air quality – odour	Odour from contaminated soils (including acid sulfate soils) resulting in amenity impacts	EPR CL2 Acid Sulfate Soil management plan EPR CL3 Waste management	Negligible

Dust emissions (risks AQ9 and AQ10)

The generation of dust during construction depends on a number of aspects including the area of exposed land, size of any stockpiles, and the type, size and moisture content of exposed soils and stockpiles. The causes of dust include wind and vehicle movements. Larger particles settle close to their source due to their larger mass, while smaller particles can be dispersed at greater distances due to their potential to become airborne. Higher moisture contents bind soil particles together, weighing it down so it is less able to disperse. The handling and transfer of spoil and other construction materials can also cause dust emissions.

Prior to construction, the project areas and temporary construction areas would be prepared for construction activity, which typically involves removal of vegetation, levelling the sites, and installing access tracks which are most often gravel. Each of these can result in exposed soils that have the potential to generate dust when subject to wind or vehicle movements. During construction, excavation and handling of spoil has the potential to generate dust from exposed and stockpiled soils, including from trucks as spoil is being removed from site.

During the excavation of the trenches, the excavated spoil would be predominately sandy and moist in nature, which is less prone to generating dust. The groundwater in the vicinity of the projects is relatively shallow (refer to Technical Report A *Groundwater*), and therefore the soils are generally expected to have a higher moisture content that would further reduce potential for dust emissions during excavation. Dust from excavation is still a risk for the projects, although it is expected to be less significant than if excavation was occurring in dryer and finer soils.

Dust generation can also be caused by truck movements on exposed surfaces including unsealed haul routes within construction areas. For the Edithvale and Bonbeach level crossing removal projects, none of the proposed external haul routes (i.e. public arterial roads) are unsealed, however internal routes within construction areas may be for short distances.

Should dust emissions occur, they have the potential to affect a number sensitive receptors nearby, predominately residents fronting Station Street and Nepean Highway.

Dust management for the projects would be conducted in accordance with EPA Publication 480 *Environmental Guidelines for Major Construction Sites* (EPR reference AQ1) and to comply with SEPP (AQM) (EPR reference AQ2). Specific measures may include:

- identifying the main dust sources and the location of sensitive land uses
- describing the proposed dust management and monitoring system including (but are not limited to):
  - the use of dust suppressants such as spraying water from a water cart kept at site to maintain the necessary moisture contents appropriate for the soil type
  - minimising the silt content of unsealed road surfaces (i.e. through using a coarser crushed rock) within project sites to reduce the potential for dust generation associated with truck movements
  - ensuring that exposed spoil (i.e. stockpiles and in trucks) are covered where possible and, in particular, during high wind events
- routinely reviewing weather predictions
- continuous air quality monitoring and real-time alert systems, where deemed appropriate, in the event of measured exceedances
- protocols for record-keeping
- protocols to ensure that site personnel advise the site manager if excessive dust emissions are observed
- describing the mitigation measures that would be implemented to ensure compliance with air quality criteria
- addressing monitoring requirements for key sensitive receptors.

Implementing the dust management measures outlined above and adopting an appropriate monitoring regime in accordance with EPR_AQ1 would minimise the risk of air quality impacts to the health and amenity of nearby residents, open spaces and community, and ensure that air quality remains below the limits set by the SEPP (AQM). Therefore, it is unlikely that there would be a greater than negligible risk of impact to amenity or human health during construction due to off-site dust. Adopting the controls outlined in this section would maintain the risk at a negligible rating.

Combustion (risk AQ11)

Air quality at Edithvale and Bonbeach could be impacted by the operation of machinery, plant and vehicles during the construction phase of the projects. Exhaust gases from vehicles and machinery have the potential to impact on human health or cause a loss of amenity in the areas surrounding the project areas and temporary construction areas.

While the projects would generate a considerable number of truck and vehicle movements, the number of trips is low relative to existing traffic volumes on the local and arterial road network adjacent to the projects (refer to Technical Report G *Traffic*).

The number of vehicle trips associated with the projects is expected to peak at between 1300 and 1600 vehicles per day for around three weeks during the excavation of the trenches. This includes vehicles of all types with approximately 1000 trucks per day removing spoil from the trenches, and 300 staff vehicles. For the remainder of the main construction period, vehicle numbers between 400 and 600 per day can be expected, comprising of workforce, supervisors and material deliveries. For comparison, existing traffic volumes have been measured on Nepean Highway and Station Street at approximately 17,000 and 10,000 vehicles, respectively, between the hours of 6am and 7pm (refer to Technical Report G *Traffic*). During the night the relative contribution of vehicles associated with the projects to local vehicle emissions would increase, however, overall vehicle numbers would be lower than during the day and this, combined with the generally good ambient air quality, means it is not expected that the projects would result in an exceedance of SEPP (AQM) criteria.

Combustion emissions at the project sites would be managed in accordance with EPA Victoria Publication 480 *Best Practice Environmental Management: Environmental Guidelines for Major Construction Sites*. Combustion emissions would be controlled by ensuring all vehicles and machinery are fitted with appropriate emission control equipment. In addition, frequent maintenance and servicing of the manufacturers' specification can also aid in the management of combustion emissions (EPR references AQ1 and AQ2).

The location of the projects adjacent to a major arterial road means the additional traffic generated by the projects relative to existing conditions is relatively low. Further, implementing combustion management measures and appropriate mitigation controls (EPR references AQ1 and AQ2) would maintain air quality to an acceptable standard in accordance with SEPP (AAQ). Combustion emissions are therefore unlikely to have an impact on human health or amenity, and adopting these controls would maintain the risk at a negligible rating.

Odour (risk AQ12)

An offensive odour is one that has the potential to affect the health and wellbeing of an individual as a result of the intensity, character, frequency and duration of the odour. Odours can be produced by the excavation of organic material (such as the acid sulfate soils discussed in Chapter 7 *Acid sulfate soils and contamination*) and vehicle exhausts.

As discussed in Chapter 7 *Acid sulfate soils and contamination*, the excavation of the rail trenches are likely to encounter potential acid sulfate soils, which under certain conditions when disturbed can produce sulphuric acid and potentially release an odour-causing gas sulphur dioxide (commonly referred to as 'rotten egg gas'). There is also the potential of encountering contaminated material which may generate odours from organic material (hydrocarbons) during excavation.

It is anticipated that odours would be produced by the potential acid sulfate soils likely to be encountered by the projects. This impact is considered to be unavoidable, however, it would be minimised by implementing an Acid Sulfate Soil Management Plan (EPR reference CL2) which would include measures for implementation to prevent oxidation of acid sulfate soils.

Waste materials encountered during construction or spills could also generate localised odours. Waste management, staff training and spill response would be managed during the construction of the projects through a CEMP (EPR reference CL3).

Given these mitigation measures it is considered unlikely that amenity would be significantly impacted by odour during construction activities, resulting in a negligible risk rating for offensive odours.

8.7.3 Operation impact assessment

Two risks were identified in relation to air quality during the operation of the Edithvale and Bonbeach level crossing removal projects. These risks relate to health and amenity, and are outlined in Table 8.17.

Table 8.17 Air quality risks – operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
AQ13	Air quality (diesel train emissions)	Diesel train emissions (such as particulates, nitrogen dioxide, sulphur dioxide, carbon monoxide benzene, polyaromatic hydrocarbons) above SEPP Air Quality Management levels resulting in health impacts to sensitive receptors.	No EPR required	Negligible
T32	Traffic (change in air quality)	Changes in traffic flows at the level crossings results in air quality impacts	EPR T4 Intersection design and performance	Negligible

Diesel train emissions (risk AQ13)

The combustion emissions from diesel engine trains on the Frankston rail line in the vicinity of the Edithvale and Bonbeach level crossing removal projects were assessed against the SEPP (AQM).

The assessment assumed worst-case scenario train volumes of six diesel freight train movements on weekdays and four movements on weekends, and two diesel powered V/Line Sprinter train movements on a weekday (twin cars rotated from Frankston to the Melbourne maintenance yard).

Combustion emissions from freight trains can cause the release of air pollutants associated with transport projects including carbon monoxide, sulphur dioxide, nitrogen dioxide, particulates, benzene and polycyclic aromatic hydrocarbons into the air environment.

Passenger trains are powered by electricity rather than a combustion or diesel engine and do not result in direct air emissions within the project area.

Air quality modelling was done to predict the change in air quality at sensitive receptors resulting from diesel trains operating through the trenches relative to existing conditions. Impacts from rail combustion were estimated from the number, type and time of diesel train movements according to the Metro Trains Melbourne timetable. The model assumed all timetabled diesel train movements occur in order to predict the maximum potential impact of the projects.

The predicted impact of air quality emissions after the removal of the level crossings were found to be well within the air quality levels specified in SEPP (AQM) – contribution of diesel trains was modelled to be six per cent or less of the total allowable level for the suite of emissions controlled by SEPP (AQM). These emissions levels would not result in health impacts to sensitive receptors. For a more detailed breakdown of emissions against intervention levels, refer to Technical Report I *Air Quality*.

On this basis, no measures to avoid, minimise and manage air quality impacts for rail combustion would be required.

Air quality impacts due to changes to traffic conditions (risk T32)

The operation of cars and trucks produces air emissions from the combustion of fuel. After the Edithvale and Bonbeach level crossings are removed and the signalised intersections operate independently of train movements, traffic movements in the local area can be expected to change. The emission rate is a function of vehicle type, speed (in particular acceleration) and distance travelled, and vehicle speed is the only parameter that would vary after the projects.

Under conditions and at times when congestion is reduced, vehicular emissions in the vicinity of the level crossings could be expected to reduce, resulting in improved air quality. The phasing of the traffic signals is a matter for the relevant road managers (i.e. VicRoads) and would be designed to optimise traffic flows, balancing the demands of Nepean Highway, Station Street, Edithvale Road and Bondi Road (EPR reference T4). Should any increase in vehicle emissions occur as a result of changed traffic conditions, air quality would be highly unlikely to breach the levels set by SEPP (AAQ) given the generally good air quality and the highly localised contribution traffic emissions at each junction make to overall air quality. As such, the risk of impact to air quality has not been modelled in detail and is considered to be negligible.

8.8 Social

Changes in the urban environment can have intended and unintended impacts on the quality of life of surrounding individuals and communities. It is important to anticipate the outcomes of proposed changes so that measures can be implemented to minimise adverse social impacts and maximise project benefits.

A social impact assessment has been prepared and is provided in Technical Report L *Social*. This section summarises the outcomes of the assessment of construction and operational impacts on residents, the community and the infrastructure facilities they use as a result of the Edithvale and Bonbeach level crossing removal projects.

8.8.1 Existing conditions

The study areas considered by the social impact assessment include:

- **regional study area**: comprising the Kingston City Council local government area (LGA)
- **local study area**: comprising the suburbs of Edithvale and Bonbeach where the level crossings are located
- **community infrastructure**: comprising the suburbs of Edithvale, Chelsea and Bonbeach, as community and recreation facilities across the three suburbs have the potential to be affected by the proposed works and temporary laydown areas.

The key findings of the existing conditions assessment, based on interpretation of the demographic characteristics of the study area, are as follows:

- the Edithvale-Seaford Wetlands, Patterson River and the coastline provide natural amenity and contribute to a large network of open space and recreation areas
- as the rail line runs parallel to the foreshore it is considered a barrier to east-west pedestrian movement and funnels essential access to the beach via the pedestrian crossings
- the two suburbs have a population of more than 12,000 people, and steady population growth is expected over the next 20 years
- approximately 15 per cent of the population of both Edithvale and Bonbeach travel to work by train
- the number of cars on the roads has increased in the Kingston City Council LGA and residents are concerned by congestion and parking issues
- there is a large amount of community infrastructure across Edithvale, Chelsea and Bonbeach, particularly child care centres and schools, aged care services, and open space and recreation facilities which are heavily used and highly valued by the community
- Chelsea is considered a welfare hub for the surrounding area with a number of health, wellbeing and social support services
- a number of community infrastructure facilities are located along the likely haul routes of Edithvale Road, Argyle Avenue and Thames Promenade.

8.8.2 Construction impact assessment

The social risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.18.

Table 8.18 Social risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
S34	Amenity	Construction activities lead to reduced amenity for nearby residents and social infrastructure facilities due to combined impacts from increased noise and vibration, dust, odour, reduced visual amenity, changes to traffic conditions.	EPR SC1 Community and Stakeholder Engagement Management Plan EPR SC2 Respite and Relocation Policy	Moderate
S35	Lifestyle disruption (cycle and pedestrians)	Disruption to cycle paths and pedestrian walkways and pedestrian crossings leading to reduced opportunities for community interaction and active lifestyle.	EPR SC1 Community and Stakeholder Engagement Management Plan EPR T1 Transport Management Plan	Minor
S36	Lifestyle disruption (rail and road users)	Disruption to rail and road operations during construction resulting in increased travel times for public transport users and other road users.	EPR SC1 Community and Stakeholder Engagement Management Plan EPR T2 Public Transport Disruption Management Plan	Minor

Amenity (risk S34)

As discussed throughout this chapter, construction activities are likely to increase noise, vibration and dust, and result in changes to traffic and the visual amenity for residents and social infrastructure facilities located near the project sites. The potential amenity impacts are addressed under other technical studies within the EES, including traffic, landscape and visual, air quality, and noise and vibration.

It is recognised that when combined, impacts associated with amenity changes are likely to temporarily disturb the local residents from going about their daily lives and limit the enjoyment of indoor and outdoor spaces in close proximity to the project area. For example, this could result in the need for doors and windows of people's homes to be closed due to construction noise on warmer days, which may lead to annoyance and frustration; or construction equipment and fencing leading to reduced visual amenity of the surrounding area.

Some disruption during construction would be unavoidable, however these impacts would be temporary for the duration of construction, with the main impacts expected to be limited to the six-week main occupation period (for a description of the duration of different aspects of the construction process, see Chapter 2 *Rationale and project descriptions*). Such impacts are most likely to be experienced by residents and community infrastructure along Station Street, Nepean Highway and truck haul routes (for a discussion of potential truck routes see Section 8.3.2 *Traffic*).

Amenity impacts would be managed through implementation of EPRs and adherence to appropriate regulatory standards for issues such as noise and air quality. Appropriate EPRs for noise, air quality and other technical areas are discussed in other sections of this chapter, and provided in full in Chapter 9 *Environmental Management Framework*.

The preparation and implementation of a Community and Stakeholder Engagement Management Plan would ensure regular and ongoing communication and engagement with residents and advanced notification of construction activities and potential disruptions (EPR reference SC1). The plan would ensure the community is kept aware of potential impacts, and would include procedures for handling and investigating complaints and enquiries.

Furthermore, a Respite and Relocation Policy would be prepared to manage situations where construction activities would be likely to cause sustained loss of amenity for residents, such as temporary loss of street access to homes or noisy night works during the main occupation period (EPR reference SC2). The Respite and Relocation Policy would be developed and implemented by the Alliance that is formed to deliver the project (for more information on the Alliance approach to delivering the projects, see Chapter 9 *Environmental Management Framework*). The Respite and Relocation Policy would provide the option for eligible residents affected by night time noise during construction to be relocated during noisy works to minimise the amenity impacts of the projects.

Some impacts during construction works would result in an actual or perceived loss of amenity, including disruption associated with relocation. The risk associated with amenity during construction has been assessed as moderate given that a Respite and Relocation Policy would be in place and clear, timely information regarding construction activities would be provided.

Lifestyle disruption (pedestrians and cyclists) (risk S35)

Changes to cycle paths and pedestrian walkways and crossings has the potential to affect community connectivity and could result in reduced opportunities for active living and community interaction. In turn, this could affect community identity and local values.

Pedestrian and cycle paths close to the projects, along haul routes, and at construction laydown areas may be affected by diversions or closures. A number of pedestrian crossings that cross the rail line would be inaccessible at times during the construction period. The lifestyle disruption from changes to access, and pedestrian and cycling paths would be temporary and may be felt at various stages of the construction phase.

Access across the rail corridor via the existing level crossings is likely to be closed during the main occupation period (six weeks) and potentially at other times during the construction works (i.e. when piling is occurring in the vicinity).

A Transport Management Plan would be implemented during the construction activities to minimise the disruption to pedestrians and cyclists (EPR reference T1). This would detail alternative cycling and pedestrian routes (if required) to maintain safe connectivity. Appropriate signage indicating disruptions and proposed detour routes would also be implemented, ensuring safe crossing points are provided. Although alternative routes and detours would be identified through careful traffic management planning, disruptions may affect residents and visitors that rely on the crossings or routes. The use of detours has the potential to increase travel time.

A Community and Stakeholder Engagement Management Plan would be implemented to ensure the local communities are advised of access changes in advance to enable them to adjust their journey and find an alternate route if required (EPR reference SC1). The plan would also include procedures for handling and investigating complaints and enquiries.

With the implementation of these controls it is unlikely that there would be significant disruption to community lifestyle during construction of the projects. Therefore, the risk of impacting community lifestyle as a result of changes to pedestrian and cycling paths would be minor.

Lifestyle disruption (rail and road users) (risk S36)

Changes to rail and road functionality have the potential to affect access routes and community connectivity, disrupt people's usual routines and affect their ability to get to where they need to go.

The overall construction activities are expected to be completed within 18 months, with the greatest disturbances to road and rail users during the closure of the Edithvale and Bonbeach train stations commencing four weeks prior to the six-week main occupation period during which time the rail line would be closed to allow construction activities to occur 24 hours a day, seven days a week. This is further discussed in Section 8.3. The continuous works during the closure of the railway would reduce the overall timeframe of the most significant disruption. Road and lane closures may be required during this time.

Weekend rail shutdowns may also be required outside the main occupation period. When the rail line is closed, commuters would need to find alternative modes of transport and familiarise themselves with the changes to transport and connectivity. As part of a Public Transport Disruption Management Plan, a bus replacement service would operate to replace train services and minimise disruptions to the extent practicable (EPR reference T2). Without the trains, additional traffic would be expected on the roads in the area (including buses replacing trains) and road users may also be delayed. Changes in travel arrangements may cause frustration for daily commuters. Stress and anxiety may also be experienced by some vulnerable groups such as the elderly and school children.

A Community Engagement and Stakeholder Management Plan would include measures to advise the community of expected changes so that they can make alternative arrangements (EPR reference SC1).

The alternative services provided would still allow people to get to their desired destination. With the implementation of these controls, the potential for road and rail users to experience lifestyle disruption would be reduced and the risk would be minor.

8.8.3 Operation impact assessment

A number of operational risks identified for the projects were considered to have potential social consequences; however, these have been addressed by other technical disciplines including landscape and visual, traffic, air quality and noise. There are no further social impacts identified for the operational activities of the projects which are not already addressed in other studies. The projects are considered to deliver a number of benefits including:

- improved amenity
  - urban design improvements – provision of design opportunities such as new station buildings and public realm improvements in station forecourts and streetscapes surrounding the projects
  - new station precincts – new infrastructure and modern station facilities to improve the general look and feel of the area
- improved access and connectivity
  - proposed crossings offer safer access over the rail corridor
  - improved road connections with the beach, and east-west links for access to local shops/businesses and community infrastructure
  - opportunities for a shared-user path, pedestrian and cycle infrastructure and linkages
  - improved station access, with two points of entry
  - improved station safety, with more access points, CCTV, Crime Prevention Through Environmental Design (CPTED) principles
  - less traffic congestion at existing level crossings.

It is noted that the Edithvale-Seaford Wetlands offer a number of avenues for community activities, such as recreational bird watching on weekends, educational tours for schools and other groups, community tree planting and opportunities for volunteering with the Friends of Edithvale-Seaford Wetlands, and opportunities for social networking, especially for elderly age groups. Significant impacts to the ecological value of the wetlands were not identified in Technical Report B *Ecology: Wetlands and groundwater dependent ecosystems* and therefore social impacts on these communities would not result from the projects.

8.9 Business

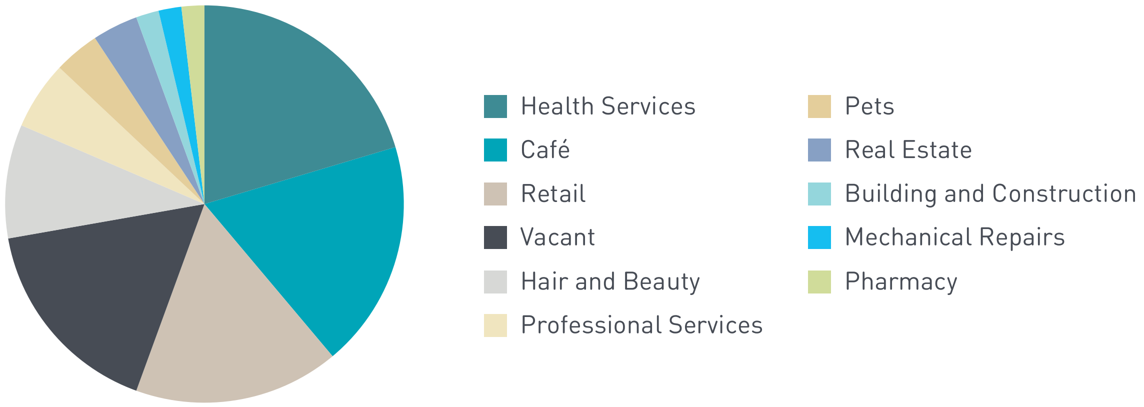
The Edithvale and Bonbeach level crossing removal projects are located opposite small but locally-significant commercial centres along Nepean Highway. These retail strips form a continuous one-sided 'high street' environment, including small tenancies comprising cafes, retail shops, and personal and professional services. The removal of the level crossings at Edithvale and Bonbeach have the potential to impact the local businesses in the immediate area during both the construction and operation phases of the projects.

A business impact assessment has been prepared and is provided in Technical Report K *Business*. This section summarises the outcomes of the assessment.

8.9.1 Existing conditions

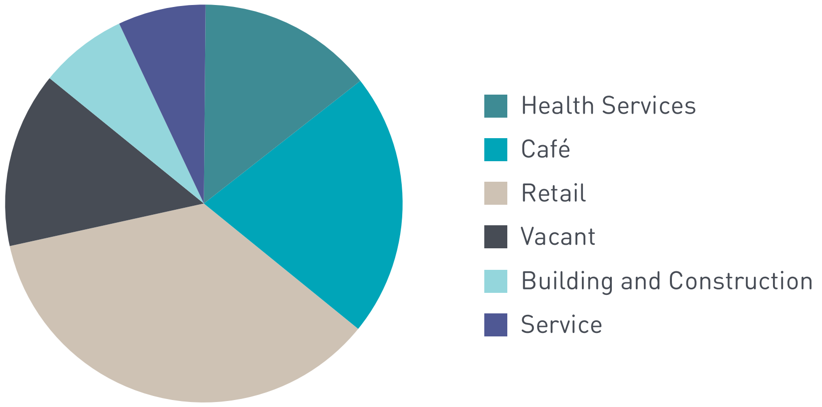
At Edithvale, local businesses are clustered in three blocks between Natal Avenue and Derrybeg Lane. As of October 2016, there are 54 businesses located along the strip consisting of mostly small retail, hospitality and service businesses. Figure 8.11 below indicates the type of businesses present at Edithvale.

Figure 8.11 Breakdown of business at Edithvale by type



At Bonbeach, local businesses are clustered in two blocks between Newberry Avenue and Harding Avenue. As of September 2016, there are 12 businesses operating along the strip which is of a smaller scale to Edithvale and therefore does not include some services at Edithvale such as a post office, supermarket and pharmacy. Figure 8.12 below indicates the types of businesses at Bonbeach.

Figure 8.12 Breakdown of business at Bonbeach by type



Most of these workplaces hire fewer than 20 people, and analysis of businesses within the relevant statistical area encompassing both Edithvale and Bonbeach indicates that the majority of businesses have a turnover of less than $50,000.

As part of the business impact assessment, LXRA engaged with Kingston City Council and local traders, to provide an understanding about how the businesses operate as a small shopping precinct, and identified potential impacts to businesses during the construction and operation phases of the projects.

Trader engagement enabled understanding of how individual businesses operate and informed the risk and impact assessment processes. At Edithvale, 20 businesses were selected for trader engagement as a representative selection of the businesses operating near the Edithvale level crossing removal project. Thirteen interviews were conducted and where interviews were not possible, letters were left at the business to inform them of the trader engagement being conducted. Similarly at Bonbeach, four interviews were conducted and three letters left. Overall, most traders were very supportive of the projects.

8.9.2 Construction impact assessment

The business risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.19 below.

Table 8.19 Business risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
B7	Decreased revenue (construction)	Businesses suffer from temporary loss of revenue due to changed traffic conditions and other construction impacts	EPR B1 Business disruption plan EPR AQ1 Air quality (construction) EPR AQ2 Air quality management EPR T1 Transport Management Plan EPR CL2 Acid Sulfate Soil Management Plan EPR NV2 Construction noise SC1 Community and Stakeholder Engagement Management Plan	Minor

Decreased business revenue (B7)

Disruption to local businesses could occur during the construction phase of the projects, through:

- the loss of available car parking
- loss of access to businesses
- impacts to amenity
- These disruptions have the potential to adversely impact businesses by causing a temporary loss of revenue.

Loss of available car parking

During the construction phase, it is likely that there would be a loss of public and commuter car spaces to temporarily accommodate construction activity. Discussions with traders raised concerns that the loss of available car parking would adversely affect businesses in the area, many of whom noted that the vast majority of their employees and customers travel by private vehicles to their businesses.

Currently, all-day car parking spaces are located on the east side of Nepean Highway which are generally used by commuters. Timed car parking spaces (approximately half to two hours in duration) are located on the west side of Nepean Highway immediately adjacent to businesses. Access to these car parking spaces could be limited during the construction phase of the projects due to lane closures. Impacts to the car parking spaces could inhibit staff access to local businesses, and potentially reduce the number of customers willing to access the precincts. Traders also expressed concerns that potential impacts could be compounded if construction activity coincides with summer when these car parks are also used by visitors to the nearby beaches.

During the construction phase, consideration would be taken to manage the treatment of car parking spaces (EPR reference B1). Planning the construction phase would consider:

- limiting the number of car parking spaces impacted by the project
- replacing any impacted car parking spaces at alternative locations where possible
- reinstating car parking at the earliest convenience
- providing dedicated parking away from commercial properties for construction workers.

Ongoing engagement with the community and traders would assist in minimising impacts to local businesses. Communicating disruptions to car parking in accordance with the projects' Community and Stakeholder Engagement Management Plan (EPR reference SC1) would provide certainty to the community and traders of times and duration of disruption potentially impacting local businesses (refer to Technical Report L *Social*).

Interrupted access to businesses

During the construction phase, rail services would be disrupted, particularly during the main occupation when the rail line is expected to be closed for up to six weeks. During this time, replacement buses would be operating. Along with disruptions to rail services, it is likely there would be intermittent road closures or detours, especially at the level crossings (Edithvale Road and Station Street/Bondi Road).

Replacement bus services are generally slower compared to train services and commuters may seek alternative public transport options such as travelling to nearby stations. This could potentially result in lower patronage compared to normal train services through Edithvale and Bonbeach railway stations. Intermittent road closures and detours would also impact the propensity for customers to access the services at Edithvale and Bonbeach, particularly where competing businesses are located in neighbouring suburbs.

Restricting access to business during the construction period could adversely impact businesses for employees and customers alike. Discussions with traders revealed concerns that the temporary losses to businesses during the construction period could become permanent. For example, some traders were concerned that customers would become accustomed to disruptions, seeking alternative options for services in other locations leading to a permanent move from the services at Edithvale and Bonbeach.

Minimising access issues to businesses would be managed by the careful planning of the construction phase (EPR references B1 and SC1). Providing alternative access to businesses where possible would be considered. Alternative access would be clearly signed and comparable in distance to current routes where available. While trains are not operating in the areas, the projects would consider providing temporary weather protected waiting areas and customer service staff for the train-replacement bus services. In addition, early communication with traders and the community would be important for locals to anticipate and plan for road and rail disruptions.

By carefully planning for the impacts to businesses during the construction phase, revenue loss can be managed by ensuring customers can still access local businesses at Edithvale and Bonbeach.

Amenity impacts to businesses

Some of the retail or hospitality businesses at Edithvale and Bonbeach have outdoor seating areas along Nepean Highway. As such, these businesses could be impacted from reduced amenity during the construction period, due to dust, odour and noise emissions making outdoor seating areas less desirable.

As discussed throughout this chapter, amenity concerns would be managed through measures that include:

- for dust: implement measures set out in EPA Publication 480 *Environmental Guidelines for Major Construction Sites* to comply with SEPP AQM (EPR references AQ1 and AQ2)
- for odour: ensure that acid sulfate soils are managed in accordance with the *Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soils*, (EPR reference CL2)
- for noise: undertake construction activities in accordance with Victorian EPA's Noise Control Guidelines to minimise the potential for noise impacts to businesses (EPR reference NV2).

These risks and associated management measures are discussed further in Chapter 7 *Acid sulfate soils and contamination*, Section 8.2 *Noise and Vibration* and Section 8.7 *Air Quality.*

Disruptions to businesses because of reductions in available car parking, interruptions to access to businesses and impacts to the amenity of businesses in the area would be mitigated by implementing controls to manage these potential impacts. Car parking would be managed by planning for disruptive construction activities and limiting the assigning of car parking spaces for construction activities and workers. Access would be managed by providing alternate access for customers to local business. Amenity impacts would be managed by dust, odour and noise management controls detailed further in this chapter. These controls would ensure the risk rating for the disruptions to businesses would be minor.

8.9.3 Operation impact assessment

The removal of the level crossings is expected to improve the general amenity of the area by providing precinct infrastructure upgrades and improved transport and pedestrian connectivity. As such, improvements to the Edithvale and Bonbeach precincts seek to encourage activation of these areas, increasing potential patronage in the area to access local businesses (refer to Attachment VII *Urban Design Guidelines – Edithvale* and Attachment VIII *Urban Design Guidelines – Bonbeach*). The business risks identified for the operational phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.20 below.

Table 8.20 Business risks – operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
B8	Decreased revenue (operation)	Existing businesses suffer from increased competition from new businesses in the railway station and/or reduced exposure to rail passengers	No EPR specified	Negligible

Decreased revenue (operation) (risk B8)

Reduction in local business revenue could occur following the completion of the projects, through:

- increased competition for businesses
- reduced visibility of businesses.

Increased competition for businesses

The construction of two new station buildings at Edithvale and Bonbeach could impact local businesses after construction is complete. The proposed Edithvale railway station building includes provision for retail space of a size that would likely be appropriate for a small kiosk, providing a service to commuters.

This presents a potential competitive risk to established similar businesses in the area and could reduce revenue for local hospitality businesses as customers may choose to use the services provided at Edithvale railway station (such as buy their morning coffee) instead of walking to the retail area on Nepean Highway.

While providing retail space at Edithvale railway station would be a risk to current businesses, this space is small and unlikely to provide any speciality services (similar to other stations in Melbourne). It is therefore considered that any impacts as a result of this business would be minimal and no management or mitigation is required as this risk would be negligible.

Reduced visibility of businesses

A number of traders identified that a portion of their customers are drawn from commuters who noticed their shopfronts and signage from the train and railway stations. The construction of a rail trench and below-ground rail station would result in businesses losing their visibility to potential customers.

While this risk is considered to be negligible, it is recognised that visibility of businesses for commuters on trains and in stations would be impacted by the removal of the level crossings. To manage this impact, ongoing discussions with traders would occur during the delivery of the project between traders and the project Alliance and relevant stakeholders (Metro Trains Melbourne and Public Transport Victoria for example) in order to establish outcomes minimising these impacts. Any physical advertising components (such as signage) would be proposed in accordance with the Urban Design Framework and the Urban Design Guidelines.

Reduction in local business revenue because of increased competition and reduced visibility is expected to be negligible, but would be mitigated through discussions with traders during the delivery of the projects.

8.10 Landscape and visual

Changes in the urban environment can have intended and unintended impacts on the landscape and visual amenity experienced by the surrounding community. It is important to anticipate the outcomes of proposed changes so that measures can be implemented to minimise adverse landscape and visual impacts and maximise project benefits.

A landscape and visual impact assessment has been prepared and is provided in Technical Report J *Landscape and Visual*. This section summarises the outcomes of the assessment of construction and operational impacts on residents, and the community, as a result of the Edithvale and Bonbeach level crossing removal projects.

8.10.1 Existing conditions

For this assessment, the landscape within and surrounding the project areas has been characterised according to five main landscape character zones (LCZ).

What is a landscape character zone?

Landscape character zones (LCZs) reflect the natural and cultural influences that shape the landscape of a particular area and are identified as sharing broadly homogenous characteristics or spatial qualities.

Each character zone identified represents a relatively consistent character based on the consideration of the following attributes:

- Landscape value (for example landscapes designated for their scenic or landscape importance or valued recreational function)
- Landscape elements that contribute to defining character (for example residential, river/creek corridors, landform and open space et cetera)
- Landscape character attributes (including scale, grain and perceptual characteristics such as the sense of remoteness, tranquillity and/or its perceived character).

The LCZs in the vicinity of the projects are characterised as:

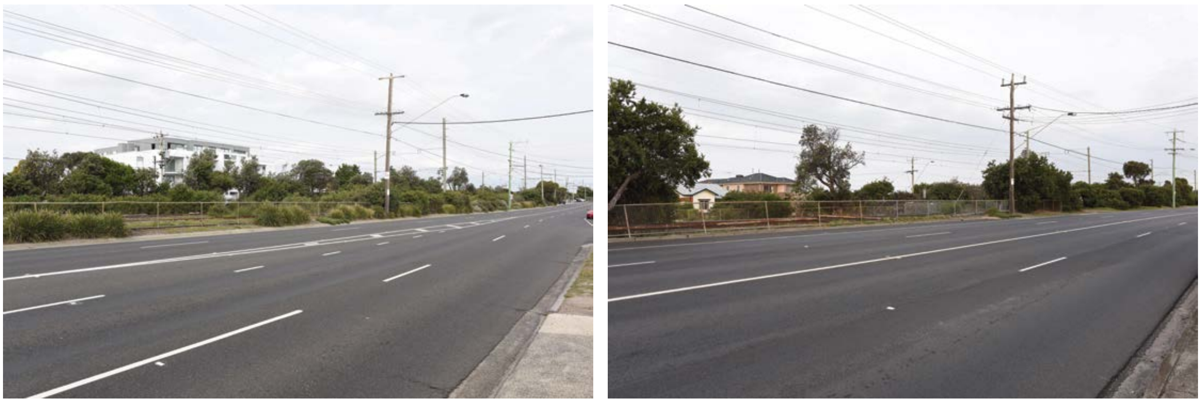
- LCZ 1 – Infrastructure corridor
- LCZ 2 – Residential
- LCZ 3 – Commercial
- LCZ 4 – Open space
- LCZ 5 – Foreshore.

These are introduced in the following sections.

LCZ 1 – Infrastructure corridor

This LCZ is characterised by the railway corridor, which is a dominant form that cuts through the surrounding landscape. The LCZ contains a moderate to low intermittent cover of low-lying shrubs and trees which are interrupted by regularly spaced gantries that support the power supply for the trains. A transparent wire fence defines the rail boundary, and high and low voltage power lines sit on the edge of the LCZ. This linear corridor is reinforced by the adjoining Nepean Highway and Station Street on both sides of the LCZ. Images from this LCZ are shown in Figure 8.13**.**

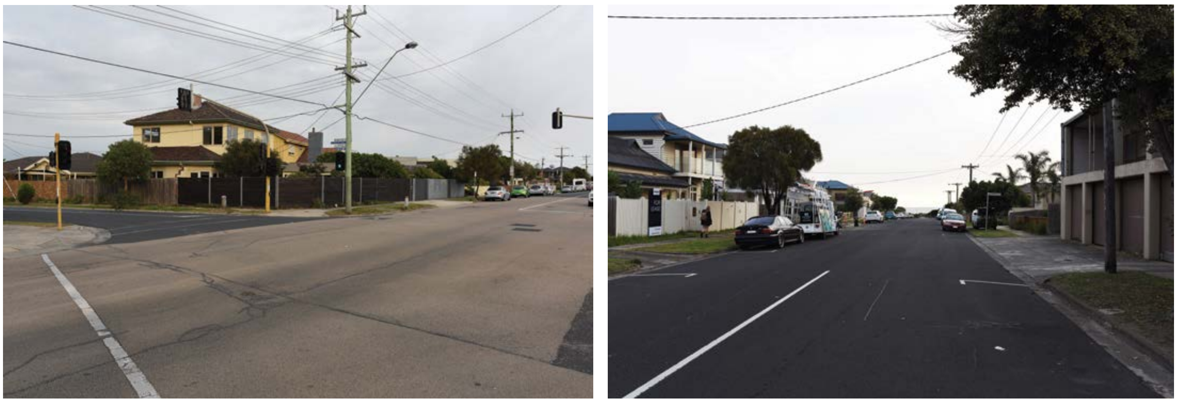
Figure 8.13 Example of the Infrastructure corridor (LCZ 1) at Edithvale (left) and Bonbeach (right)



LCZ 2 – Residential

This LCZ is located within a wider coastal area and consists of a combination of old and new residential developments. Built form typically ranges from single and double storey housing, rising up to four storeys in some locations. LCZ 2 sits either side of the infrastructure corridor (LCZ 1). The residential LCZ west of the railway line is typically subject to substantial levels of renovation and redevelopment, with less redevelopment occurring east of the railway line. The landscape incorporates scattered vegetation and limited street tree planting in residential streets. Images from this LCZ are shown in Figure 8.14.

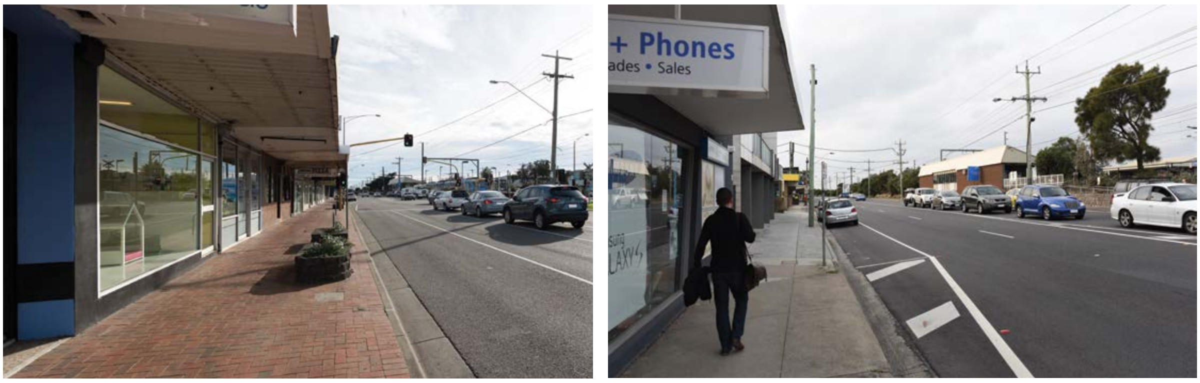
Figure 8.14 Example of residential (LCZ 2) at Edithvale (left) and Bonbeach (right)



LCZ 3 – Commercial

This LCZ comprises a small linear commercial centre containing a mix of shops, small businesses and cafes/restaurants on the western side of the Nepean Highway at both Edithvale and Bonbeach. The commercial centres are generally located in one or two storey premises with ground floor shops and residential above. The commercial LCZs are located adjacent the Edithvale and Bonbeach train stations. The character is primarily influenced by the utilitarian nature of the road setting, with no significant level of setback from the highway and no street trees. Images from this LCZ are shown in Figure 8.15.

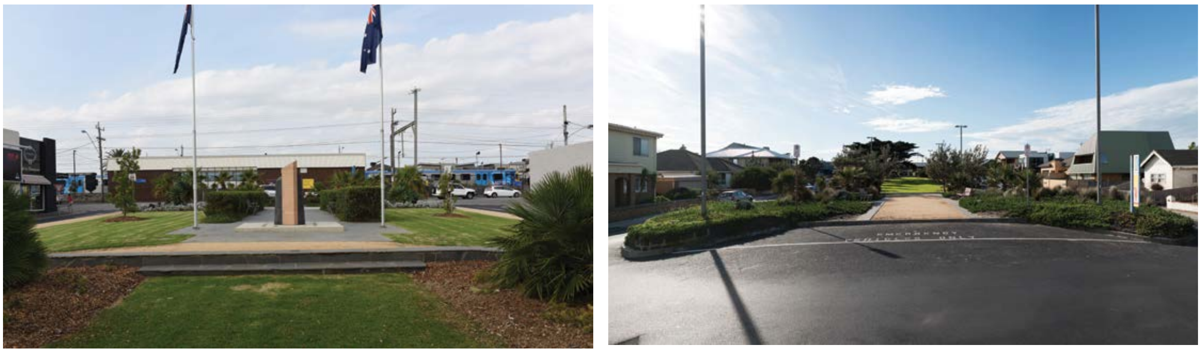
Figure 8.15 Example of commercial corridor (LCZ 3) at Edithvale (left) and Bonbeach (right)



LCZ 4 – Open space

This LCZ is only relevant to Edithvale, where Beeson Reserve, situated in the centre of the project area, and Regents Park, situated on the northern boundary of the project area are located. Beeson Reserve acts as a gateway between the station and the coast, and includes formal planting, with fringing vegetation and low scattered trees on the boundary adjacent to The Esplanade. At the northern boundary of the project area, Regents Park and small portion of the Rossdale Golf Club lie within the project area boundary. Images from this LCZ are shown in Figure 8.16.

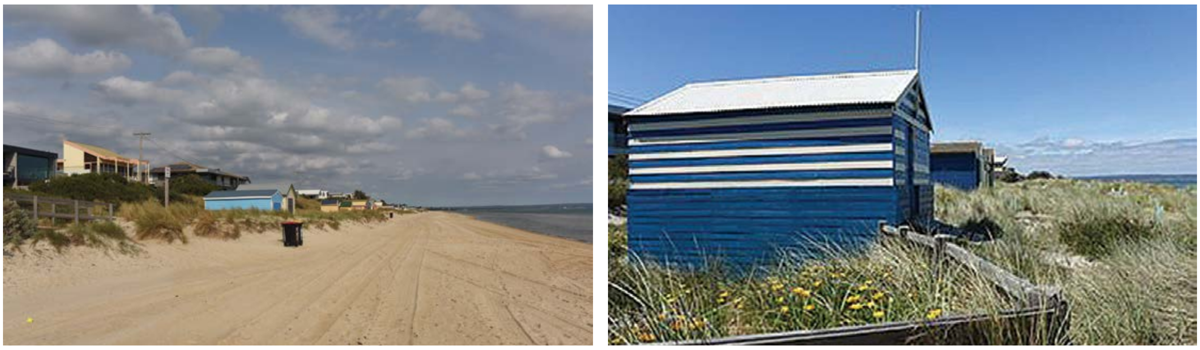
Figure 8.16 Example of open space corridor (LCZ 4) at Edithvale (Beeson Reserve)



LCZ 5 – Foreshore

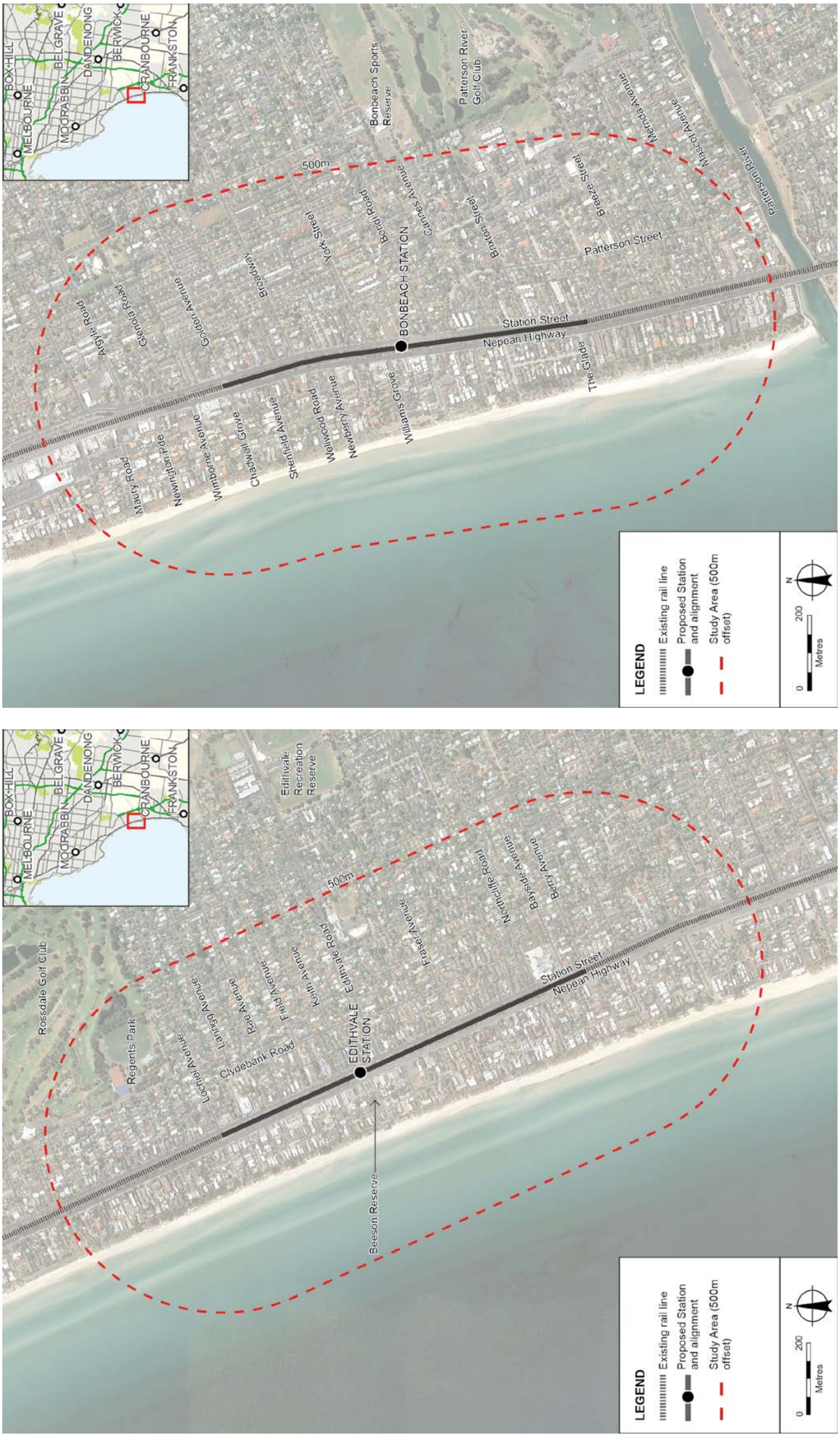
This LCZ forms part of a long coastal strip that extends from Mordialloc Creek to Carrum and overlooks Port Phillip Bay. The LCZ comprises low dunes and a variety of remnant vegetation. Images from this LCZ are shown in Figure 8.17.

Figure 8.17 Example of foreshore (LCZ 5) at Edithvale (left) and Bonbeach (right)



The locations of these LCZs are shown in Figure 8.18.

Figure 8.18 Landscape character zones in the vicinity of Edithvale (below) and Bonbeach (top)



8.10.2 Construction impact assessment

The potential landscape and visual risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.21.

Table 8.21 Landscape and visual risk – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
LV37	Lighting	Lighting leads to disturbance to sensitive receptors/fauna and leads to a perceived loss of amenity.	EPR LV3 Light spillage	Negligible
LV39	Visual impacts (construction)	Visual impact of construction activities, ancillary facilities results in perceived loss of visual amenity by residents or the community.	EPR UD2 Hoardings EPR AQ1 Air quality (construction)	Minor

Lighting (risk LV37)

Lighting of construction areas may be required when night works are planned to occur. This is expected to be necessary during the main occupation period, and periodically at other times. Without controls, lighting has the potential to spill into adjoining residential areas and disturb the amenity.

To prevent potential impacts on residents and community facilities, measures would be developed and implemented to minimise the amount of light which spills beyond the construction area (EPR reference LV3). This would include the use of directional lighting and screening to prevent light spill beyond the construction site. With the implementation of these controls, the risk of lighting resulting in a loss of amenity would be negligible.

Visual impact (risk LV39)

Visual impacts during construction have the potential to result from the introduction of construction activities and ancillary facilities into the existing landscape resulting in the loss of visual amenity in the area. Visual impacts could result from the following activities/features:

- ground levelling to those areas adjoining the trench, and the resulting loss of the existing endemic tree and shrub cover within these areas
- protection and/or relocation of utility services
- views of machinery such as piling plant, excavators and trucks seen above work site hoardings
- transport of spoil, excavated material and groundwater offsite, potentially visually impacting views along some local roads
- construction of above ground elements including station and substation buildings, pedestrian overpasses and decking over the rail trench.
- new rail infrastructure including excavation and installation of ballast, overhead line equipment and rail.

The proposed construction activities would be expected to be completed within 18 months. The main rail occupation period would comprise the most intense construction activity, and therefore the greatest potential for visual impacts, and would occur over a six-week period. During this time, works would be expected across a larger area as the existing stations are demolished, trenches are excavated and new stations are established.

Outside of the main occupation, the greatest change to views would be expected to result from piling rigs or other earthworks and traffic management. These impacts would generally be expected to be localised, and would ‘migrate’ along the rail corridor as the piling works progress along the linear alignment.

To mitigate the potential impacts caused by the construction activities, views to construction areas would be screened through the use of hoarding to minimise the extent of construction activities that would be visible to residents and the passing community (EPR reference UD2). It is noted that the use of hoarding would still result in a change to the view. Measures would be implemented to minimise the generation of dust to ensure it would not affect amenity (EPR reference AQ1).

The changes to views would generally be limited to the residents immediately adjacent to the rail corridor and passing commuters. Given the transient nature of passing commuters, the changes would be expected to have limited impact on the amenity experienced as part of their overall journey.

The risk associated with the loss of visual amenity during construction has been assessed as minor, given that hoarding would be in place to screen the main activities, controls would be implemented to mitigate dust and any impact would be temporary in nature.

8.10.3 Operation impact assessment

The potential landscape and visual risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.22.

Table 8.22 Landscape and visual risks – operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
LV37	Lighting	Lighting leads to disturbance to sensitive receptors/fauna and leads to a perceived loss of amenity.	EPR LV2 Lighting	Negligible
LV38	Landscape character	Change of landscape character in infrastructure corridor/commercial/ residential/open space/foreshore areas resulting in perceived loss of amenity.	EPR LV1 Landscape and visual opportunities EPR UD1 Urban Design Guidelines	Negligible
LV40	Visual impact (general)	Visual impact of changes to rail infrastructure (excluding pedestrian overpasses and substation) results in perceived loss of visual amenity by residents or the community.	EPR LV1 Landscape and visual opportunities EPR UD1 Urban Design Guidelines	Minor
LV41	Visual Impact (ped overpasses, substation)	Visual impact of new pedestrian overpasses (Edithvale and Bonbeach) and substation (Edithvale) results in perceived loss of visual amenity by residents or the community	EPR LV1 Landscape and visual opportunities EPR UD1 Urban Design Guidelines	Moderate

Lighting (risk LV37)

Lighting associated with the project would be generally limited to the immediate station precinct, including car parking, station building and plaza, with levels sufficient to meet relevant standards for security and safety levels. Lighting would be designed in accordance with the relevant standards to prevent unnecessary light generation (EPR reference LV2).

It is anticipated that the light condition would not be significantly different to the existing condition and therefore the risk of amenity loss due to the lighting is considered to be negligible.

Landscape character (risk LV38)

A change to the landscape within the project areas has the potential to affect the character of each area and result in a perceived loss of amenity. The main project elements that have the potential to affect the character of the landscape include:

- transformation of an above ground rail corridor into a below-ground trench
- new station buildings
- pedestrian ramps and overpasses crossing the rail corridor
- crash barriers, throw screens and security fencing surrounding the trench
- substation at Edithvale
- commuter car parking located on decking over part of the rail corridor
- loss of existing vegetation.

To inform the level of risk applicable to the project, an assessment of impacts to the LCZs at each of the project areas was undertaken. The assessment of impacts is available in Technical Report J *Landscape and Visual.* The impacts were assessed using a specific methodology for considering landscape impacts. This methodology was then used to inform the risk assessment presented in this EES. The specific landscape assessment method identified impact ratings ranging from negligible to moderate for different locations. These ratings have been used to identify the overall level of risk for each project for each of the risks in Table 8.22.

A crash barrier and throw screen would be required around the trench for safety reasons, and this would present a new element within the landscape. The proposed crash barrier is described in Chapter 2 *Rationale and project descriptions* and would be a 0.8 to 1.8 metre high concrete crash barrier along the top of the trench. A screen would be included on top of the crash barrier up to a total height of 2.4 metres. Around the station areas, the proposed island platform and trench infrastructure would fill a larger width of the existing rail corridor with hard infrastructure than the current stations, leaving less room available to allow planted vegetation to soften the landscape as trees and shrubs currently do. This would also be the case near the new carpark on decking over the trench which would limit the opportunity for deep garden beds. However, the island platform design enables improved urban design outcome, improved circulation around the station as the same set of stairs and lifts can access both up and down platforms, and is a better CPTED outcome as all passengers will be on the same platform maximising passive surveillance. The application of the Urban Design Guidelines would ensure soft landscaping is included in the final design where space and safety requirements allow. The new station building would be expected to result in minimal impact to the landscape since it would be replacing an existing building of similar size at both sites.

Impacts would be expected to be greatest for the landscape within the infrastructure corridor (LCZ 1) where the main changes are occurring, as well as at the interfacing residential areas (LCZ 2) that overlook the rail corridor. It should be noted that the residential area would be expected to be impacted only at the interface with the rail corridor, and impacts would diminish with distance from the rail corridor.

Adherence to the Urban Design Guidelines applicable to each site would minimise impacts to the extent possible by ensuring the detailed design considers the existing setting and results in high quality urban design response to improve amenity (EPR references UD1 and LV1). As a result, the risk associated with a change in landscape character resulting in a perceived loss of amenity is considered negligible.

Visual impact (risk LV40 and LV41)

Changes to the landscape have the potential to affect the visual amenity experienced by nearby residents and the wider community. Some of the main project elements that could affect visual amenity include; new station buildings, safety barriers and throw screens required around the trenches, new pedestrian over passes, and the new substation building at Edithvale.

As discussed in relation to landscape character, the barrier and throw screen established around the trench would be a new visual element within the landscape. The barrier would extend the full length of the trench where there is no deck, and would alter views from some residences and businesses. Although room would be limited at some locations, soft landscaping would be provided along the trench where space allows, which would help to soften views of these new hard infrastructure elements.

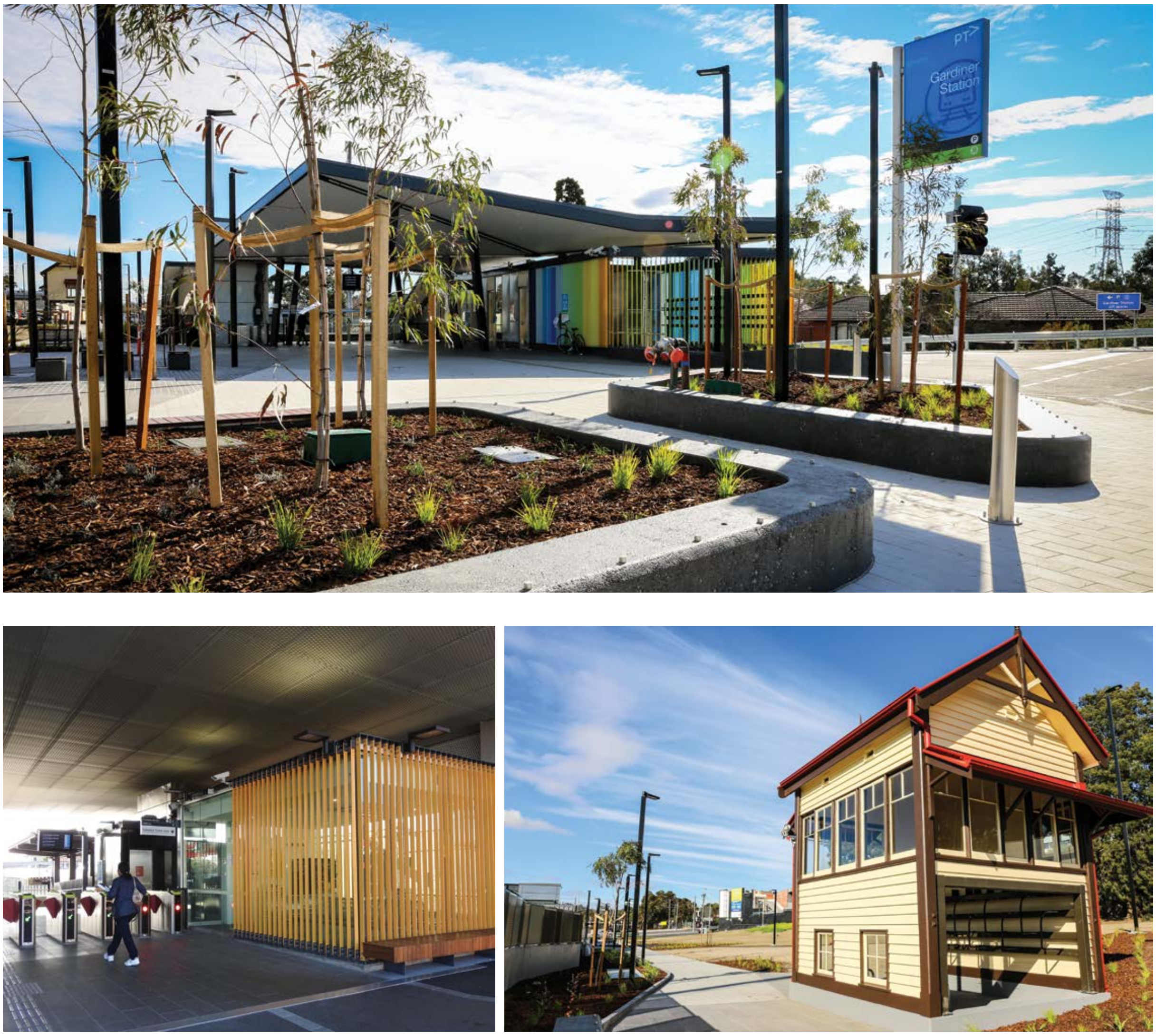
The new station buildings would replace the existing stations which were constructed in the 1980s, and be constructed on a deck slightly south of their current position (see Figure 8.20). A second platform access would be located on the southern (carpark) deck. These new buildings would be designed in accordance with the Urban Design Guidelines specific to each site (EPR references UD1 and LV1). In doing so, the design would be required to consider the existing setting and implement an innovative and high-quality urban design response.

Urban Design

The existing Edithvale and Bonbeach stations have reached the end of their design life, and the projects would include their replacement with a new modern facility that is integrated and well-considered. The Urban Design Guidelines (UDGs) set out the requirements for a considered and high-quality approach to architectural, landscape and infrastructure design across the projects.

Chapter 11 *Urban design approach* provides details of the urban design concept for the projects. Urban design outcomes that have been achieved for other level crossing removal projects are provided below, as examples of the quality design outcome expected for these projects.

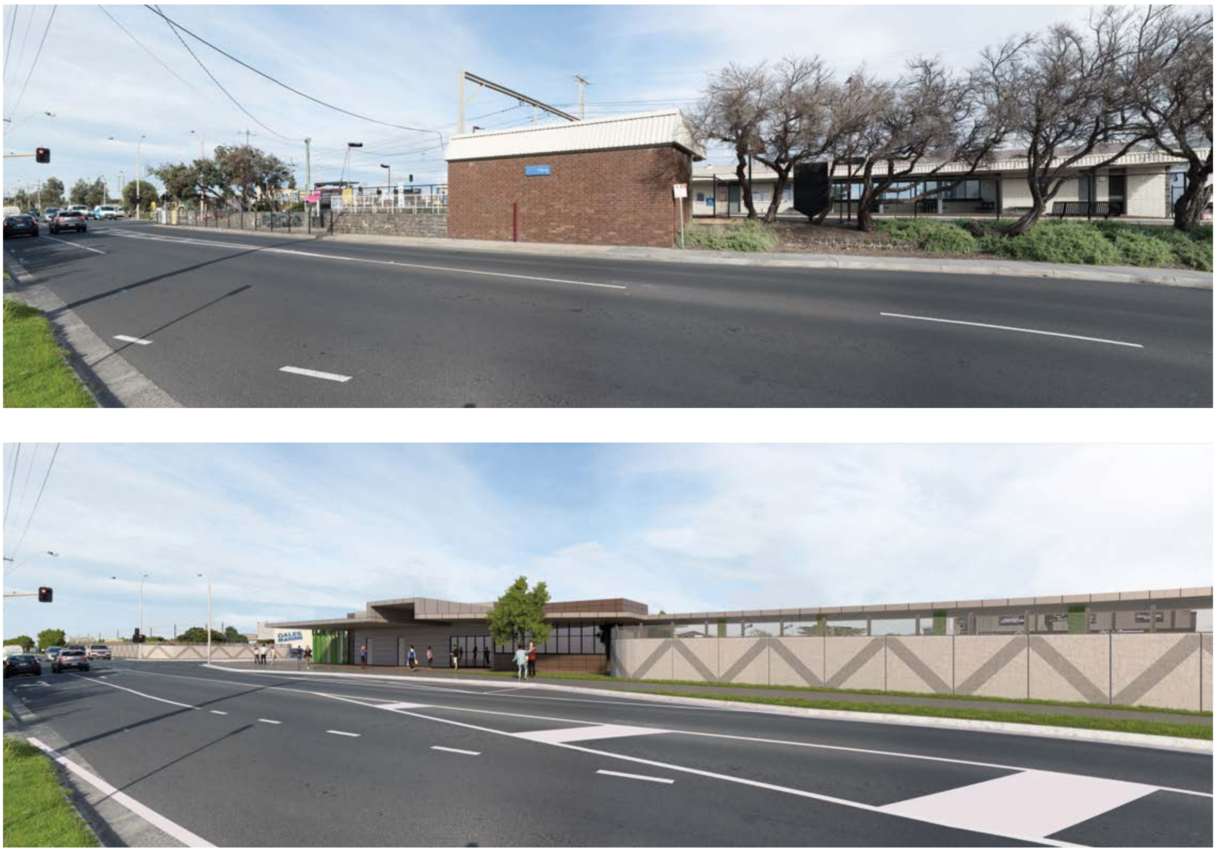
Figure 8.19 Examples of urban design outcomes for level crossing removal projects



An urban design outcome that aligns with the Urban Design Guidelines has been assumed for the purpose of this assessment and has been applied to the visualisations used to assess the potential impacts of the projects. The urban design shown in photo-montages is an example of a possible design in response to the UDGs, and should be considered as an example only.

It should also be noted that many elements depicted within the photo-montages are still subject to detailed design. This includes the position of the overhead powerlines which will be determined at a later stage. A worst-case outcome has been assumed for each viewpoint assessed, making this a conservative assessment of landscape and visual impacts.

Figure 8.20 Before and after photo-montage of a potential design outcome of the barriers and new station



The pedestrian overpasses and substation at Edithvale would be expected to have the most significant impact due to their elevation and position as a new building within the landscape. A number of new pedestrian overpasses would be constructed to retain connectivity across the rail corridor (see Figure 8.21). These would be *Disability Discrimination Act* 1992 (DDA) compliant to serve all members of the community, and would therefore include a ramp up to an elevated walkway that would pass over the trench and barriers. At Edithvale, a new substation structure would be established in one of two locations on a deck adjacent to the carpark (see Figure 8.22).

The substation would be enclosed within security fencing and consist of a prefabricated building with an approximate footprint of 35 metres long, seven metres wide and six metres tall. The substation and pedestrian overpasses would be designed in accordance with the Urban Design Guidelines specific to each site (EPR reference UD1), which would include the use of soft landscaping to minimise the impact of these features where possible.

Consultation with stakeholders during the detailed design process and adherence to the Urban Design Guidelines would ensure the design of the new structures minimises the potential for visual impacts on nearby residents and the surrounding community. As a result, the risk associated with a change to views within the project areas resulting in a perceived loss of amenity would generally be considered minor, or moderate for the pedestrian overhead bridges and substation.

Figure 8.21 Before and after photo-montage of a potential design outcome of the barriers and pedestrian overhead pass

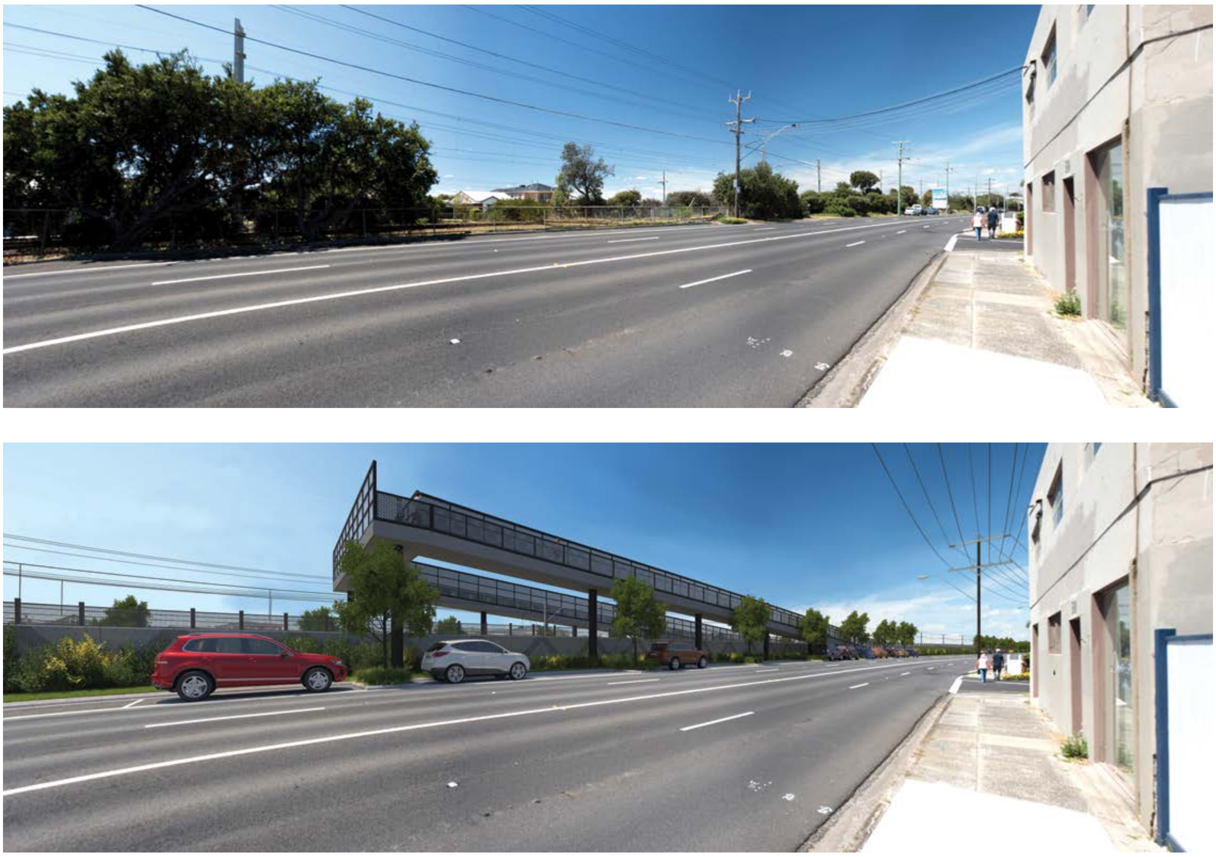
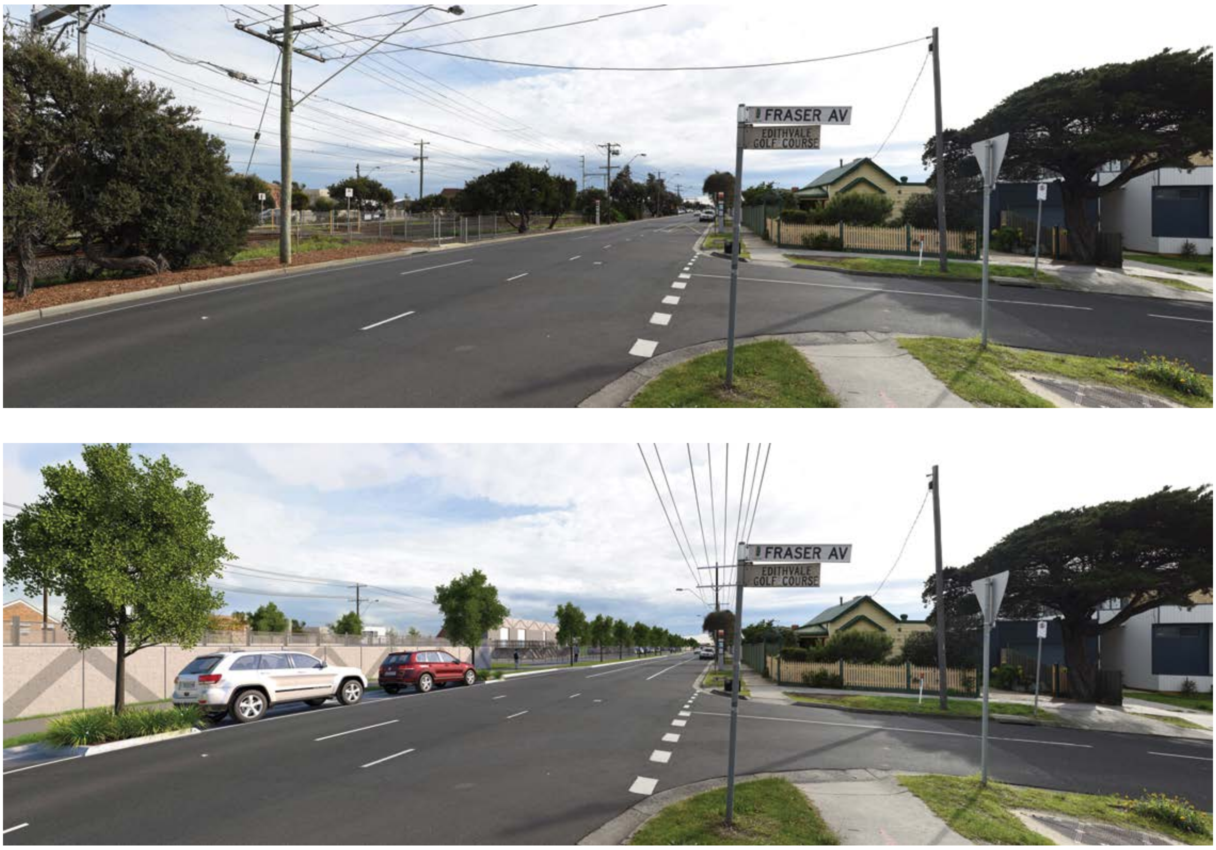


Figure 8.22 Before and after photo-montage of a potential design outcome of the barriers



8.11 Ecology

The Edithvale and Bonbeach level crossing removal projects are located within a largely urbanised region, dominated by residential and, to a lesser extent, commercial development. Much of the original vegetation that would have occupied the project areas has been historically cleared, however small patches of remnant (indigenous) vegetation persist. Some vegetation has been planted for its amenity value.

To facilitate the removal of the level crossings, excavation works would be required to construct the trench. During the construction phase, the ground surface of the project areas would be cleared. This would include the clearance of existing parts of the rail track, ballast, associated rail infrastructure (such as overhead signalling and power structures) and the clearance of vegetation. Ecological values within the project areas would be impacted during construction due to the necessary removal of vegetation, through construction activities such as stockpiling or soil compaction and from disturbance such as dust generation, noise or vibration. No effects on ecological values at the level crossing project areas have been identified for the operational phase.

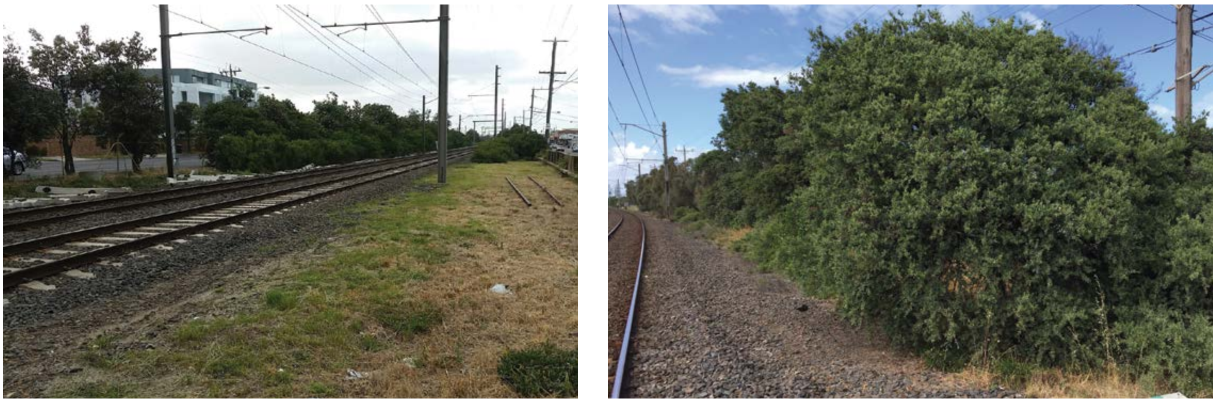
An ecological impact assessment of flora and fauna within the project areas has been prepared and is provided in Technical Report D *Ecology: Project Areas.* This section summarises the outcomes of the assessment for the Edithvale and Bonbeach level crossing removal projects.

8.11.1 Existing conditions

Vegetation within the Edithvale and Bonbeach project areas is generally of poor quality – a consequence of the historical and continuing land use as an active rail line (see Figure 8.23), and the increase in development of land adjacent to the rail corridor.

Roadways line both sides of the rail corridor. An important transport route in the Nepean Highway lies to the west and Station Street (a local access road) to the east. Beyond the roadways, residential land use dominates with commercial strips opposite both Edithvale and Bonbeach railway stations on Nepean Highway. Vegetation quality within the rail corridors at Edithvale and Bonbeach reflects the continuing pressure from both weed infestations and from regular disturbance through management and maintenance within the rail corridor.

Figure 8.23 Rail corridor at Edithvale (left) and Bonbeach (right)



Remnant Vegetation

Remnant vegetation includes both patches of native vegetation and scattered indigenous trees and their removal is controlled through the application of the *Planning and Environment Act 1987*. A remnant patch of native vegetation is defined by the Department of Environment, Water, Land and Planning (DELWP, 2013) as either:

- an area of vegetation indigenous to Victoria, with or without trees, where at least 25 per cent of the total perennial (a plant with a lifecycle of more than two years) understorey plant cover is native plants, or
- an area with three or more indigenous trees where the tree canopy cover is at least 20 per cent.

A scattered tree is defined as a native canopy tree that does not form part of a remnant patch.

In Victoria, patches of remnant vegetation are classified by Ecological Vegetation Classes (EVC) which are based on the general ecological characteristics and underlying geology of the vegetation. Remnant vegetation identified and mapped at Edithvale and Bonbeach are summarised in Table 8.23.

Table 8.23 Summary of remnant native vegetation at Edithvale and Bonbeach

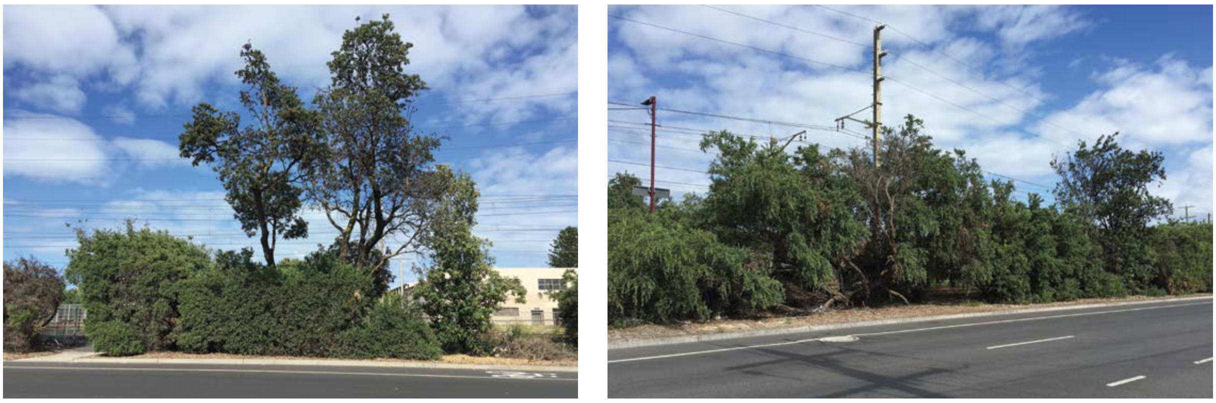
Vegetation	Edithvale	Bonbeach
Patches of remnant vegetation	21 patches comprising 1.15 hectares: • 20 patches of Coast Banksia Woodland (EVC 2) totalling 1.12 hectares • 1 patch of Coastal Dune Scrub (EVC 160) of 0.027 hectares	17 patches comprising 1.05 hectares: • 14 patches of Coast Banksia Woodland (EVC 2) totalling 1 hectare • 3 patches of Coastal Dune Scrub (EVC 160) totalling 0.05 hectares
Scattered trees	3	1

The two identified EVCs are described as follows:

Coast Banksia Woodland (EVC 2)

Within the project area, Coast Banksia Woodland (EVC 2) is generally restricted to long, linear patches of vegetation outside the rail corridor. This EVC was identified by the presence of an overstorey of Coast Banksia to 15 metres in height, growing over a mid-storey shrub layer comprising nearly solely of Coast Tea-tree with the occasional planted Drooping She-oak. Ground layer vegetation is dominated by grassy and broad-leaf weed species with few indigenous species recorded (refer to Figure 8.24). Coast Banksia Woodland is classified 'vulnerable' in the Gippsland Plain Bioregion.

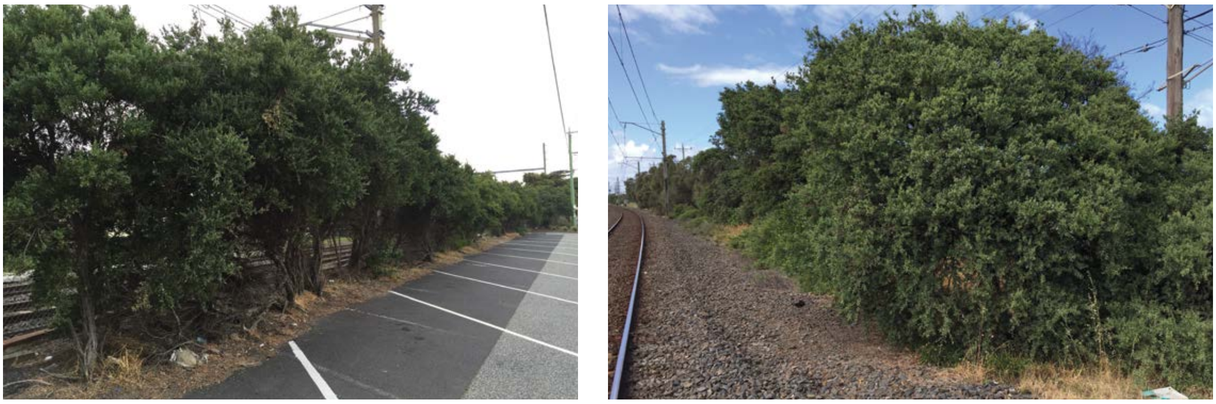
Figure 8.24 Coast Banksia Woodland at Edithvale (left) and Bonbeach (right)



Coastal Dune Scrub (EVC 160)

Coastal Dune Scrub (EVC 160) was identified within both the Edithvale and Bonbeach project areas. The patches assessed were typically species-poor, often comprised only of Coast Tea-tree with an understorey dominated by weed species (refer Figure 8.25). Coastal Dune Scrub is considered to be 'depleted' in the Gippsland Plain Bioregion.

Figure 8.25 Coastal Dune Scrub at Edithvale (left) and Bonbeach (right)



EVC 2 and EVC 160 were often difficult to distinguish as they both grow in the same sandy soil type and are often represented by similar species. For the purposes of this assessment, they were differentiated by the presence of Coast Banksia which were considered indicative of EVC 2. A total of four patches of Coastal Dune Scrub were recorded at both sites – one at Edithvale and three at Bonbeach.

In addition to the EVCs, a total of four scattered trees were identified – three at Edithvale and one at Bonbeach.

Planted vegetation

Planted vegetation includes street trees, shrubs and understorey species planted for their amenity value within urban landscapes. Such plantings may include native or exotic species and are exempt from the need for a permit to be removed. Regardless of the need for a permit, this assessment recognises the significance of this vegetation to communities and the environment.

Planted vegetation was recorded at both Edithvale and Bonbeach, and comprised both indigenous and exotic species. Amenity plantings around Edithvale Station comprise species including Silver Princess and Red-flowering Gum, with the occasional plantings of Coast Tea-tree and Coast Banksia. The plantings at Edithvale Station appeared to be regularly maintained.

A local community group is responsible for the maintenance of the amenity plantings lining the rail corridor at Bonbeach Station. Similar *Eucalypt* species to Edithvale have been planted at Bonbeach, and grow above a ground layer of a variety of shrubs and grasses.

Fauna

Habitat for terrestrial fauna within the project areas is limited in both extent and quality owning to the historical disturbance within the project areas. Potential habitat is primarily restricted to narrow, linear strips of vegetation on either side of the rail corridor.

Fauna species observed at Edithvale and Bonbeach include species typical of suburban environments- Australian Magpie, Australian Raven, Magpie-lark, Rainbow Lorikeet, Red Wattlebird and the exotic Common Myna and Common Starling.

No habitat suitable for threated fauna was identified.

What is a threatened species?

'Threatened species' refers to those species that are considered 'threatened' in Victoria or Australia. This includes species that are listed as:

- 'threatened' under the *Flora and Fauna Guarantee Act 1988*
- 'vulnerable' or 'endangered' on the Victorian Rare or Threatened species advisory lists or
- 'vulnerable', 'endangered' or 'critically endangered' under the *Environment Protection and Biodiversity Conservation Act 1999*.

Protected flora species

The *Flora and Fauna Guarantee Act 1988* (the FFG Act) provides provides legal protection for native plants or communities whose populations are at risk. Three species classified as 'protected' and listed under the protected flora controls of the Act were observed during the field assessment:

- White Sallow-wattle
- Coast Wattle
- Cotton Fireweed.

Pest animals, declared weeds and pathogens

Pest animals, weeds and pathogens can have the potential to cause environmental harm and impact human health. The control of pest animals, weeds and pathogens are managed under the *Catchment and Land Protection Act 1994* (CaLP Act). Under this Act, species of plants and animals can be declared as noxious weeds and pest animals. Similarly, pathogens can be listed under the CaLP Act as a potentially threatening process – a process which may have the capability to threaten the survival, abundance or evolutionary development of any flora and fauna.

No pest animals were observed within the project areas, however the Red Fox, European Rabbit and Feral Cat are likely to occur in the project areas. Of these species, the Red Fox and European Rabbit are declared as established pest animals under the CaLP Act.

Eleven weed species listed under the CaLP Act were identified at both project areas, six of which are recognised as Weeds of National Significance. While impacts will occur during the construction phase, they are permanent changes that will continue into the operation phases. Therefore they are assessed as operational impacts. These include the Bridal Creeper, Spear Thistle, English Broom, Flax-leaf Broom, African Box-thorn, Blackberry and Gorse.

Pathogens are a bacterium, virus or other microorganism that can cause disease in plants, animals or humans. Two pathogens were identified for consideration for the projects – Chytrid Fungus and Cinnamon Fungus. These pathogens are listed as potentially threatening processes.

8.11.2 Construction impact assessment

The ecological impact assessment evaluated the impact of the projects' construction and operation on the ecological values within the project areas. The local ecology risks identified for the construction phase of the Edithvale and Bonbeach level crossing removal projects are outlined in Table 8.24.

Table 8.24 Ecology risks – construction

Risk ID	Risk name	Risk pathway	Final EPRs	Residual Risk
E42	Native vegetation removal	Removal of native vegetation (patches and scattered trees) within the project area, impacting native vegetation extent	EPR FF1 Native vegetation and habitat	Minor
E43	Removal of protected flora	Loss of protected flora species from within the project area reducing the abundance of that species	EPR FF2 FFG permits	Minor
E44	Removal of habitat for threatened species	Removal of habitat for threatened flora and/or fauna species within the project area affecting the persistence of the species.	No EPR specified	Negligible
E45	Removal of habitat (non-threatened fauna)	Removal of habitat resulting in the displacement, injury or death of wildlife protected under the *Wildlife Act 1975* causing animal welfare concerns.	EPR FF4 Fauna EPR FF6 Landscaping for wildlife EPR UD1 Urban Design Guidelines	Minor
E46	Disturbance to fauna (project areas)	Increase in noise, vibration and artificial light affecting fauna behaviour within or adjacent to project area resulting in a decline in fauna abundance and/or diversity	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management EPR NV2 Construction noise EPR SW1 Stormwater management – construction EPR LV2 Lighting EPR LV3 Light spillage	Negligible
E47	Threatening process (weeds, pathogens, pests)	Spread of weeds listed under the CaLP Act resulting in the decline in quality of native vegetation in the rail corridor adjacent to the project area. Spread, or introduction, of pathogens/ pest animals resulting in the exacerbation of a threatening process listed under the FFG Act and EPBC Act.	EPR FF3 Weeds and pathogens	Negligible
E48	Threatening process (habitat fragmentation)	Fragmentation of the narrow habitat corridor within and beyond the rail reserve, resulting in the exacerbation of a threatening process listed under the FFG Act	EPR FF1 Native vegetation and habitat EPR FF6 Landscaping for wildlife EPR UD1 Urban Design Guidelines	Minor

Risk ID	Risk name	Risk pathway	Final EPRs	Residual Risk
E49	Unintended impacts on vegetation and habitat	Unintended impacts on adjacent/ retained vegetation as a result of: • Inappropriate placement of construction stockpiling resulting in unintended impacts to vegetation and habitat. • Soil compaction or excavation causing root damage and vegetation loss within (or adjacent to) the project area. • Dust generation during construction impacting the health of vegetation. • Spills of chemicals resulting in pollution of native vegetation or (particularly Edithvale Wetland and/or Wannarkladdin Wetland) either through surface or groundwater flows. • Unintended loss of vegetation to be retained from accidental plant/ personnel access to designated no-go areas or areas outside of the defined project area.	EPR FF5 Protection of retained/adjacent vegetation	Negligible

Removal of vegetation (risk E42)

The projects would require the removal of native vegetation, however not all vegetation listed in Table 8.23 would be impacted. During the development of the detailed design, the disturbance footprint of the projects would likely decrease, avoiding the need for the removal of some of the vegetation within the project areas.

In a conservative scenario where all native vegetation within the project areas is required to be removed, this would equate to the loss of approximately 2.2 hectares of native vegetation and four scattered trees.

The removal of any remnant vegetation is controlled by the *Planning and Environment Act 1987* and the Kingston Planning Scheme. The removal, destruction or lopping of native vegetation for the projects will be subject to the requirements of the *Permitted clearing of native vegetation – Biodiversity assessment guidelines*, in accordance with the transitional arrangements established under Clause 52.17 of the planning scheme. These guidelines require that any removal of native vegetation is offset to ensure that the removal of the native vegetation would result in an equivalent contribution to Victoria's biodiversity. The guidelines prescribe a method for determining the offset requirements based on the location, type, extent and quality of impacted vegetation.

Whilst the removal of some remnant vegetation is likely to be unavoidable, the extent of impact on native vegetation in the project areas would likely be minimised by reducing the project footprint and offsetting any vegetation removed (EPR reference FF1). Therefore, the risk of impacting the native vegetation during the projects construction phase is minor.

Protected flora species (risk E43)

Three species listed as ‘protected’ under the FFG Act were observed at the Edithvale and Bonbeach project areas. These are the White Sallow-wattle, the Coast Wattle and Cotton Fireweed. Any loss of these protected flora species during the construction phase would reduce the abundance of that species in the project areas.

While it is conservatively estimated that all vegetation within the project areas would be removed, the project footprints would be designed to minimise this impact. If these species are impacted, a ‘permit to take protected flora’ under the FFG Act would be required from DELWP (EPR reference FF2).

Obtaining this permission would not reduce the loss of the protected flora during construction of the projects, and therefore the abundance of that species in the area would be reduced. However, due to the low presence of protected flora identified within the project areas and the fact that some individuals are considered to have been planted, the impact to that species overall as a result of the projects is considered to be minor.

Removal of habitat for non-threatened fauna (risk E45)

Native and exotic trees and shrubs within the project areas have the potential to provide habitat for non-threatened fauna such as possums and birds. Minimising the clearance of vegetation and construction activities would result in a lower potential for the displacement, injury or death of non-threatened fauna species.

As design progresses, consideration would be given to the suitability of plantings to accommodate habitat for non-threatened fauna. Where possible, landscaping would incorporate native and indigenous species to provide valuable foraging resources for wildlife likely to be impacted by the projects (EPR references FF6 and UD1). Where possible, the use of mature plants would reinstate habitat at a faster rate.

Projects would consider design opportunities to avoid the removal of habitat. Where fauna habitat is identified for removal, a suitably qualified specialist would be engaged to check for fauna occupancy and ensure compliance with the *Wildlife Act 1975*. All necessary authorisations must be obtained prior to commencement of works (EPR reference FF4).

Minimisation of vegetation loss, the implementation of wildlife recovery (if required) and use of native flora species where possible in landscaping would ensure the risk of displacement, injury or death of wildlife protected under the *Wildlife Act 1975* due to habitat removal would be minor.

Threatening processes under the Flora and Fauna Guarantee Act (risk E48)

Removal of vegetation within the project areas at Edithvale and Bonbeach would interrupt the mostly continuous vegetative link within the rail corridor of the Frankston rail line. Vegetation clearance is an ongoing impact associated with the development of land. The removal of vegetation within the project areas would contribute to a threatening process (fragmentation of vegetation strips) listed under the FFG Act.

The fragmentation of habitat within the rail corridor is a long-term and continuing issue due to the intensification of disturbance of the land over time. Minimising the project footprint would minimise the fragmentation of habitat within the rail corridor (EPR references FF1 and UD1). Landscaping around new infrastructure would consider the suitability of plantings to provide valuable feeding resources for birds that may be impacted by the projects (EPR references FF6 and UD1), which also considers the management of the displacement of non-threatened species. Where possible, landscaping would incorporate native and indigenous species to provide valuable foraging resources for bird species that may be impacted by the projects.

The consequence of further fragmentation is considered to be minor as this threatening process adds to an ongoing pre-existing issue. By considering the reduction of the project footprint and the suitability of landscaping to provide habitat and feeding resources, this risk is considered to be minor.

Pest animals, declared weeds and pathogens (risk E47)

The presence of pest animals, weeds and pathogens can cause impacts to native species and human health. To manage this risk, procedures would be implemented to prevent the spread of pest species, weeds and pathogens with priority given to controlling Weeds of National Significance (EPR reference FF3). Specific measures to manage this risk would include wash-down procedures to remove seeds from plant and equipment and measures to contain runoff from spoil stockpiles to prevent the spread of soil into native vegetation in the project areas. These measures would be utilised to prevent the spread of declared weeds and pathogens outside of the project areas.

While this risk is considered to be negligible, LXRA is committed to delivering projects with no overall increase in the diversity, coverage or spread of pest animals, weed species or pathogens within the project areas.

Unintended impacts on vegetation, habitat, fauna (risks E46, and E49)

Construction activities within and surrounding the project areas may inadvertently impact vegetation, habitat and fauna. This could occur as a result of:

- placement of stockpiling resulting in the smothering of native vegetation
- soil compaction or excavation causing root damage and vegetation loss
- dust generated during construction settling on and impacting the health of vegetation
- noise, vibration, dust or light disturbing and displacing native wildlife.

Dust would be managed in accordance with EPA Publication 480 *Environmental Guidelines for Major Construction Sites* in order to comply with limits set out in the SEPP (AQM) (EPR references AQ1 and AQ2). Measures to be implemented for dust management are discussed further in Section 8.7 of this chapter.

Noise would be managed in accordance with Victorian EPA's *Noise Control Guidelines* in order to minimise the potential for noise impacts at sensitive receptors (EPR reference NV2). Vibration caused by construction activities are not anticipated to result in any significant impacts. However, management of vibration would be provided through vibration monitoring at sensitive receptors (EPR reference NV2). Measures to be implemented for noise and vibration are discussed further in Section 8.2 *Noise and Vibration* of this chapter.

Management of construction activities would include the implementation of (EPR reference FF5):

- 'no go' zone delineation and fencing with appropriate signage around vegetation retained in the construction areas
- best practice spill sedimentation and water runoff measures as set out within EPA Publication 480 *Environmental Guidelines for Major Construction Sites* (as discussed further in Section 8.6 of this chapter)
- limiting light spillage at construction sites (particularly during the 24-hour construction time during the main occupation).

Surface water runoff and runoff quality has the potential to impact on vegetation to be retained. It can cause the smothering of protected vegetation at construction sites, or disturb the quality of the soil where vegetation is growing. In addition, runoff can contribute to the spreading of weeds by transporting weed seeds. Runoff from construction sites would be managed to meet EPA water quality requirements, in accordance with EPA Publication 480 *Environmental Guidelines for Major Construction Sites*, SEPP (Waters of Victoria) and in consultation with Kingston City Council (EPR reference SW1). The duration and size of stockpiles would be considered in order to minimise any potential mobilisation of excavated material from runoff (EPR reference SW1). Measures to be implemented for runoff are discussed further in Section 8.6 *Surface Water* of this chapter.

Implementing measures to manage dust, noise and vibration, runoff and light such as dust management measures and 'no go' zones, would ensure retained ecological values would be sufficiently protected from construction activities. Therefore, it is unlikely that there would be an impact to retained ecological values during construction. Adopting these controls would maintain the risk at a negligible rating.

Removal of habitat for threatened species (risk E44)

The construction of the level crossings at Edithvale and Bonbeach could potentially remove habitat for threatened species protected under the FFG Act, the Victorian Rare or Threatened species advisory lists or the EPBC Act.

No threatened species have a greater than low likelihood of occurrence within the Edithvale and Bonbeach project areas, and none were observed during site inspections. Therefore, the risk of impacts to habitat for threatened species is considered negligible.

8.12 Land use

Land use relates to the manner in which land is currently used and the way in which land use may change in the future. Land use underpins the form, function, amenity and appearance of the existing and future urban environment and the character of a place or location, and is informed by a variety of state and local government policies.

The projects have the potential to affect land use within the project areas and on land nearby to the project areas, either temporarily or on a permanent basis. The projects would result in some temporary changes to nearby existing land uses, for a limited duration and in a contained manner during construction.

A land use impact assessment has been prepared and is provided in Technical Report F *Land Use*. This assessment identifies potential land use impacts, risks and relevant management and mitigation. This section summarises the outcomes of the assessment for the Edithvale and Bonbeach projects.

8.12.1 Existing conditions

The Frankston rail corridor is on land reserved for transport purposes, and provides passenger connectivity between the suburb of Frankston and Melbourne's central business district. In the vicinity of the Edithvale and Bonbeach project areas, the rail corridor runs approximately parallel to the Port Phillip Bay foreshore and adjacent to Nepean Highway, a major north-south arterial road. Both projects are within the Kingston City Council.

Both suburbs are characterised by long-established and predominantly residential land use substantially developed from the 1950s and 1960s. Like much of metropolitan Melbourne, residential land use is experiencing increases in dwelling density primarily through redevelopment and construction of additional dwellings on existing land. The suburbs also contain a variety of parks, reserves, and community and recreational facilities including the Port Phillip Foreshore, lifesaving clubs, Beeson Reserve and the Rossdale Golf Club. There are a number of schools which are located within the study areas, including the Edithvale, Bonbeach and Chelsea Primary Schools.

As discussed in Section 8.9, both Edithvale and Bonbeach are served by small groups of commercial and retail premises along Nepean Highway. These include cafes, small shops, and personal and professional services.

The rail corridor at both project locations is generally zoned Public Use Zone 4 – Transport (PUZ4). This zoning reflects the historic, current and intended future land use for the purpose of public transport.

8.12.2 Construction impact assessment

The land use risks identified for the construction phase of the projects are outlined in Table 8.25.

Table 8.25 Land use risks – construction

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
LUP25	Inconsistent land use	The project is inconsistent with existing or future land use, including relevant land use policy	EPR LP1 Land use (construction)	Negligible

Inconsistent land use (risk LU25)

During the construction phase, the projects are anticipated to result in a number of temporary changes to existing land uses, including:

- temporary occupation of road reserves for construction purposes
- temporary use of site offices and construction laydown areas
- relocation and construction of utilities.

Construction is expected to be completed within an 18-month period, and the impacts to land use are therefore expected to be limited to this duration.

Use of Roads

The temporary use of roads, or parts of roads for construction activity is inconsistent with the existing land use of the roads for transport purposes. Due to this inconsistent land use and the transport impacts discussed in Section 8.3, both projects would be constructed to:

- avoid or minimise inconsistent land uses on private and public land
- avoid or minimise inconsistency with adjacent land uses
- return and reinstate land to enable previous land uses to recommence (EPR reference LP1).

The risk relating to land use was considered negligible and would be maintained as negligible through the avoidance or minimisation of inconsistent land uses and the return and reinstatement of land (EPR reference LP1).

Utilities

The construction of the projects may require existing utilities such as water, gas, sewerage and telecommunication services to be relocated to enable the project to be constructed in a safe and efficient manner. The relocation of existing utilities both within the rail corridor and adjacent road reserves is consistent with the use of the land, and reflects existing practices. The avoidance or minimisation of inconsistent land uses and the return and reinstatement of land (EPR reference LP1) mean that the risk relating to land use is considered negligible.

Amenity impacts

Activity during the construction period may have impacts on amenity including air quality, noise and vibration and an increase in construction traffic. The impacts of these amenity matters have been considered, together with relevant EPRs to manage the identified risks, within this chapter of the EES and relevant supporting Technical Reports. The potential amenity impacts are not expected to impact on land use and as such can be considered to be negligible. Accordingly, no mitigation measures specific to managing amenity impacts on land use are considered necessary.

Laydown areas

The construction phases of the projects would require the temporary use of site offices and construction laydown areas. The location of site offices and laydown areas will be determined in accordance with the EPRs set out in Chapter 9 *Environmental Management Framework*.

Land utilised for site offices and construction laydown would be selected and managed to minimise land use conflict, site area, and impact to existing land uses within and adjacent to the identified areas, and be reinstated to enable previous land uses to recommence.

The following options exist for temporary site offices and construction laydown areas:

- existing industrial land in the area that would be leased for the duration of the construction of the projects
- rural land
- land used for existing passive or active recreational purposes.

If sites on land zoned for industrial purposes can be identified, it is unlikely that the projects would result in an inconsistent land use as construction laydown areas are akin to an industrial use, however LXRA may still need to seek planning approval to use the land. If rural land, or land currently used as public open space for passive or active recreation is used, this could result in a temporary land uses that are inconsistent with the land use controls affecting the land. LXRA would seek planning approval to be able to use the land.

Planning approval under any scenario would require an assessment of the potential effects appropriate to the identified site, consultation with potentially affected parties, and include specific conditions that the project would need to meet to manage any potential impacts.

8.12.3 Operation impact assessment

A single risk was identified in relation to land use for the operation phase of the Edithvale and Bonbeach projects and is outlined in Table 8.26.

Table 8.26 Land use risk – operation

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk
LUP25	Inconsistent land use	The project is inconsistent with existing or future land use, including relevant land use policy	EPR LP1 Land use (construction)	Negligible

Inconsistent land use (risk LUP25)

The completed projects, including the rail trenches, station buildings, on-deck carparking and the electrical substation at Edithvale would be wholly within the existing rail corridor which is consistent with the historic, current and intended future use of the land. No land acquisition is required for the projects.

Matters relating to amenity, including air quality, landscape and visual impact, noise and vibration have been considered, together with relevant EPRs to manage the identified risks during the operational phase of the projects.

Furthermore, the projects are supported by, are consistent with, and implement a number of state and local government land use policies, including *Plan Melbourne* and the local planning policy framework which are discussed further in Technical Report F *Land Use*.

The risk of the projects resulting in a land use impact during operation that is inconsistent with existing or future land use, including those envisaged by relevant policies is therefore considered to be negligible.

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10 SUSTAINABILITY AND CLIMATE CHANGE

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10.1 Introduction

This chapter describes LXRA's sustainability framework which is applied across all 50 of the level crossing removal projects, including Edithvale and Bonbeach, to ensure that best practice sustainability outcomes are achieved across the planning, design, construction and operation of each project. It also sets out how relevant assessments have taken climate change into account in determining the potential effects of the projects over time.

10.2 Sustainability and the Environment Effects Statement

Section 3.2 of the Environment Effects Statement (EES) Scoping Requirements states that:

> *'the EES should demonstrate how the project will achieve a balance of economic, social and environmental outcomes that contribute to ecologically sustainable development and provide a net community benefit over the short and long term.'*
>
> *This includes:*
>
> - *the evaluation of the implications of the project for the implementation of applicable legislation and policy, including the principles and objectives of ecologically sustainable development and environmental protection*
> - *an environmental management approach and performance measures to ensure any effects are identified and avoided, minimised or mitigated*
> - *the development of a numerical hydrogeological model based on a sound conceptual characterisation of the local and regional groundwater systems, to form the basis for assessment of potential effects under current and climate change scenarios*
> - *identify and evaluate effects on groundwater in the vicinity of the project works and the Edithvale-Seaford Wetlands, including the likely extent, magnitude and duration of groundwater level or flow paths during operation, taking into account climate change scenarios*
> - *project environmental performance requirements that define project-wide environmental outcomes to be achieved should be clearly described in the EMF, specifically energy and greenhouse gas emissions (S3.5)*

Incorporating climate change risk into relevant EES technical studies has enabled LXRA to assess the predicted impacts of climate change to the Port Phillip area, and ensure that any predicted changes would not be exacerbated by the Bonbeach and Edithvale projects. These findings would inform final design of the projects, and are discussed further in Chapter 5 *Modelling the water environment*.

In addition, LXRA has mandated that all projects achieve a minimum 'excellent' Infrastructure Sustainability (IS) rating and 4 star Green Star rating, which provide a framework for designing and delivering ecologically sustainable development principles in major projects, including:

- reduction in greenhouse gas emissions during construction and operation
- climate change adaptation
- climate change mitigation
- water efficiency
- waste and resource recovery
- energy efficiency
- materials reduction and efficiency
- environmental management and protection.

10.3 Sustainability legislative context

Table 10.1 outlines the legislation that is relevant to LXRA's adoption of sustainability principles and approach.

Table 10.1 Relevant sustainability legislation

Legislation	Implications for the projects
Transport Integration Act 2010	The *Transport Integration Act 2010* requires that the development of the transport system has regard to sustainability and sustainable design. The Act has provisions relevant to LXRA's sustainability framework, including: • protecting, conserving and improving the natural environment • avoiding, minimising and offsetting harm to the local and global environment, including through transport-related emissions and pollutants and the loss of biodiversity • promoting forms of transport and the use of forms of energy and transport technologies which have the least impact on the natural environment and reduce the overall contribution of transport-related greenhouse gas emissions • improving the environmental performance of all forms of transport and the forms of energy used in transport • preparing for and adapting to the challenges presented by climate change.
Climate Change Act 2017	The *Climate Change Act 2017* provides a framework to manage climate change risks, maximise the opportunities that arise from decisive action, and drive Victoria's transition to a climate resilient community and economy with net zero emissions by 2050. The Act: • establishes a long-term emissions reduction target of net zero by 2050 • requires five yearly interim targets, to keep Victoria on track to meet this long-term target • requires the Victorian Government to consider climate change in all its decision making, policies, processes and programs • requires the Victorian Government to develop a climate change strategy every five years, which will set out how Victoria will meet its targets and adapt to the impacts of climate change (from 2020) • requires adaptation action plans for key systems (including the transport system) that are either vulnerable to the impacts of climate change or essential to ensure Victoria is prepared (from 2021) • establishes a pledging model to reduce emissions from government's own operations and from key emitting sectors of the economy (including transport) • establishes a system of periodic reporting to provide transparency, accountability and ensure the community remains informed.

Legislation	Implications for the projects
Environment Protection Act 1970	The *Environment Protection Act 1970* outlines specific principles of integration of economic, social and environmental considerations in major projects: • sound environmental practices and procedures should be adopted as a basis for ecologically sustainable development for the benefit of all human beings and the environment • requires the effective integration of economic, social and environmental considerations in decision-making processes with the need to improve community well-being and the benefit of future generations • the measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.
Planning and Environment Act 1987	The purpose of *Planning and Environment Act 1987* is to establish a framework for planning the use, development and protection of land in Victoria. Section 4(1) of the Act outlines planning objectives that are relevant to LXRA's sustainability goals: • to provide for the fair, orderly, economic and sustainable use and development of land • to provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity • to secure a pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria.
Kingston Planning Scheme	The Kingston Planning Scheme embeds sustainability and climate change objectives in its local planning policy framework and municipal strategic statement: • Clause 11.06-6 Sustainability and resilience: Mitigate exposure to natural hazards and adapt to the impacts of climate change, by identifying at-risk areas using the best available climate change science • Clause 13 Environmental risks and clause 13.01 Climate change impacts: Planning should adopt a best practice environmental management and risk management approach which aims to avoid or minimise environmental degradation and hazards • Clause 15.02 Sustainable development and Clause 15.02-1 Energy and resource efficiency: Encourage land use and development that is consistent with the efficient use of energy and the minimisation of greenhouse gas emissions.

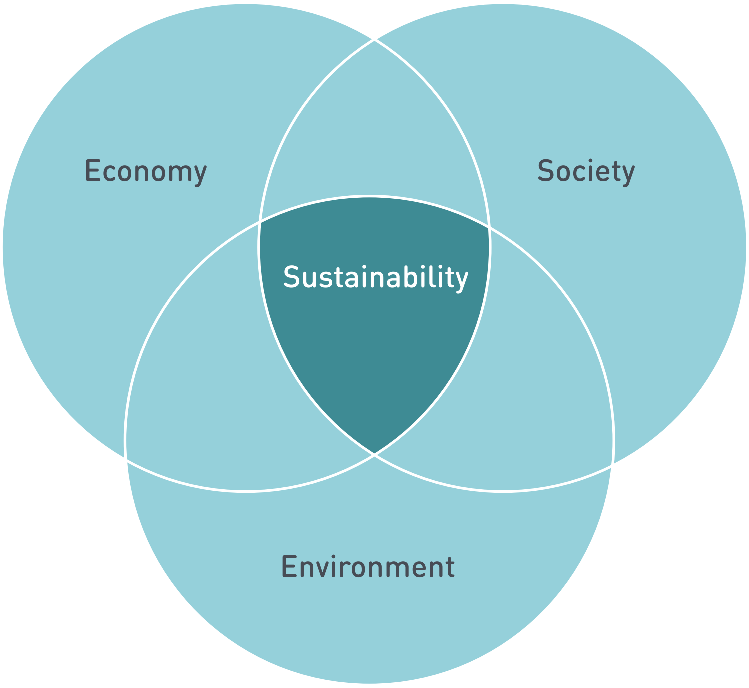
10.4 What is sustainability?

The 1987 Brundtland Commission was influential in defining the meaning of 'sustainable development' (World Commission on Environment and Development, 1987):

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

The Brundtland definition is largely dependent on the 'triple bottom line' approach to sustainability, which focuses on balancing environmental, social, and economic issues to achieve sustainable development, as shown in Figure 10.1.

Figure 10.1 Sustainability Venn diagram



Though this definition is frequently cited and has had a powerful influence on the world's social and ecological agenda, the concept of sustainability has significantly advanced since its inception, especially in the context of urban environments. In defining sustainability for the LXRA Program, there are two principles that have been taken into consideration:

- **Permanence** – improving the long-term environmental and social benefits of the metropolitan transport network for future generations of Melburnians. This means understanding and increasing the values of sustainability within a project over the full life cycle.
- **Place** – recognising how people and nature experience and interact with the metropolitan transport network, and how these interactions influence ecological, cultural and economic exchanges.

Drawing on the Brundtland definition, the triple bottom line approach and these two additional principles, LXRA has adopted the following definition of sustainability for all its projects:

> 'A sustainable Level Crossing Removal Program recognises people, place, and permanence as it delivers improved mobility across Melbourne's metropolitan transport network, striving for best practice in planning and construction in order to leave a lasting legacy of environmental, social and economic benefits for current and future Melburnians.'

10.5 LXRA's sustainability framework

LXRA recognises that opportunities to achieve long-term sustainable outcomes would improve if there is a clear, overarching governance framework in place to ensure that sustainability is adopted across all phases of the level crossing removal program.

For this reason, LXRA has developed a sustainability framework that includes:

- a sustainability strategy
- the LXRA sustainability policy
- the Victorian Climate Change Risk Assessment Framework
- the adoption of two sustainability rating tools.

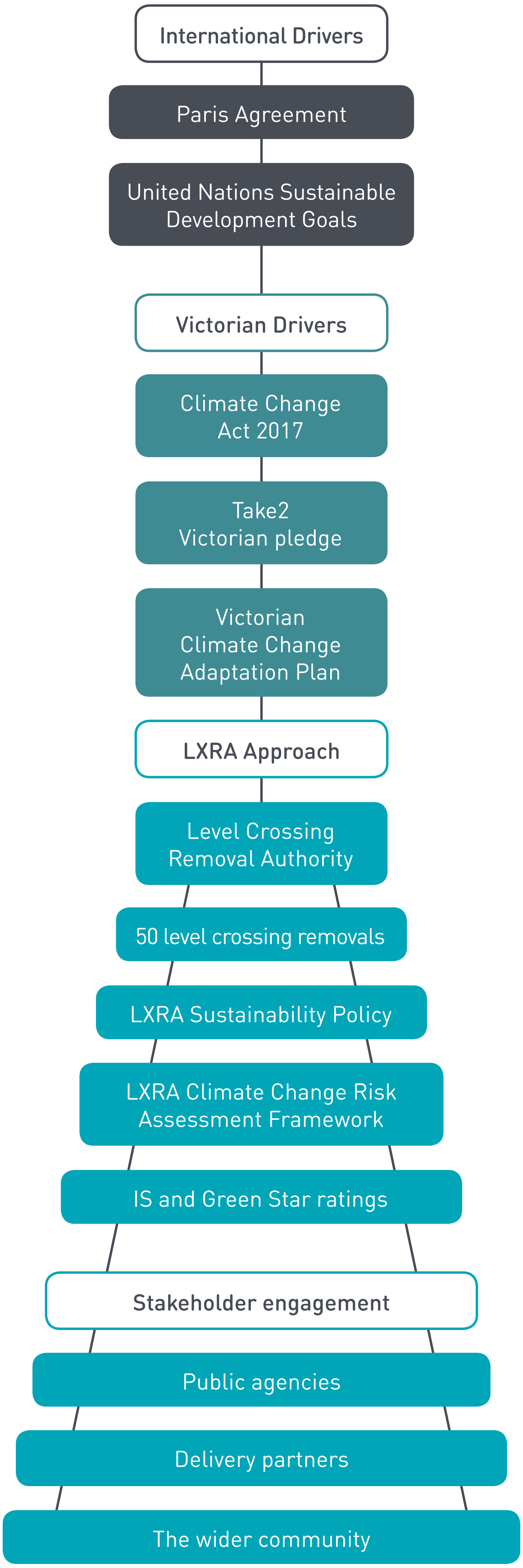
Figure 10.2 demonstrates how the sustainability framework is directly linked to a broader, global approach to sustainability. The Paris Agreement is the major international driver behind LXRA's commitment to action on climate change, and the Victorian Government Climate Change Act 2017 sets out a clear policy framework (consistent with the Paris Agreement) for managing climate change risks in Victoria.

In order for LXRA's ambitious targets to be met, LXRA is encouraging other government agencies, the private sector and the wider community to actively engage in the design and delivery of the Level Crossing Removal Program. For more information on Victoria's Climate Change framework, visit: <www.climatechange.vic.gov.au/victorias-climate-change-framework>.

10.5.1 Sustainability strategy

Sustainability is at the core of LXRA's corporate governance principles, and links directly to LXRA's overarching strategic objectives, which incorporates the principles of Great Network, Great Places, Great Partnerships, Great Engagement and Great People. The strategy aligns specific sustainability outcomes with each of the 'greats' and sets out sustainability targets for the different stages of level crossing design, delivery and operation with the intention of improving sustainability across the entire public transport network.

Figure 10.2 LXRA's sustainability reach


International Drivers
Paris Agreement
United Nations Sustainable Development Goals
Victorian Drivers
Climate Change Act 2017
Take2 Victorian pledge
Victorian Climate Change Adaptation Plan
LXRA Approach
Level Crossing Removal Authority
50 level crossing removals
LXRA Sustainability Policy
LXRA Climate Change Risk Assessment Framework
IS and Green Star ratings
Stakeholder engagement
Public agencies
Delivery partners
The wider community

10.5.2 LXRA's sustainability policy

In 2015, LXRA adopted a sustainability policy to ensure the principles of environmental, social and economic sustainability would be included in all our projects. The sustainability policy gives effect to the following vision:

> 'To achieve excellent environmental, social and economic outcomes across all phases of the level crossing removal project (project) in order to deliver an integrated project that connects the community in an environmentally sustainable manner.'

The sustainability policy works to provide a consistent, Program-wide approach to sustainable infrastructure, in order to deliver an integrated, sustainable transport network. A copy of this policy is provided in EES Attachment IV *LXRA corporate policies*.

10.5.3 LXRA's program climate change risk assessment framework

Assessing the risk of climate change to a project and mitigating its impacts is of critical importance to achieving sustainable infrastructure, which is why a climate change assessment is a mandatory requirement under the IS rating tool. To assist contractors, LXRA has developed a climate change risk assessment framework to guide all its projects by responding to climate change in two ways:

- **from a program perspective**: how can LXRA work with stakeholders to mitigate and adapt to climate change risks across the wider transport network?
- **from a project perspective**: addressing project-specific climate change risks through design, construction and operation, for example, planning for more frequent and longer heatwaves, and reducing the amount of greenhouse gas emissions to the atmosphere, and ensuring the detailed design responds to these risks.

However, there are two sides in considering climate change for a project. Firstly, a climate change assessment needs to be undertaken to inform the project designs and ensure that the infrastructure remains operable as the climate pressures evolve. Secondly, the potential effects of the project need to be taken into account in the long term, against the backdrop of a changing climate. Section 10.6 details how the risk of climate change has been considered in the EES process.

10.5.4 Sustainability rating tools

To benchmark and monitor performance against the program sustainability vision, LXRA has committed to achieving a program rating of 'excellent' under the Infrastructure Sustainability (IS) rating tool and minimum '4 star' under the Green Star rating tool. This requirement is passed onto LXRA's delivery partners on each project.

The adoption of these sustainability rating tools allows LXRA to facilitate a consistent approach to design and delivery for all level crossing removal projects.

In a large-scale major infrastructure project, it can be challenging to ensure that all projects are meeting the sustainability benchmarks that LXRA requires. Sustainability rating tools rely heavily on documented evidence to prove that sustainability is embedded in a project. As such they are very effective in ensuring that standards, procedures and sustainability requirements are addressed consistently across a program as far-reaching as LXRA.

Sustainability rating tools provide:

- a framework for measuring, monitoring and reporting during construction and operation
- enhanced communication between LXRA and stakeholders through a universal language that all stakeholders can understand and adopt
- the ability to target specific sustainability themes that are of importance to LXRA and to individual projects
- a flexible approach, with options to pursue alternative, yet equivalent pathways for meeting targeted themes
- an avenue for the industry to develop innovative sustainability solutions
- independent assessment and verification by third party verification panels comprised of recognised industry experts.

LXRA has identified the need to assess and benchmark sustainability in both the civil infrastructure and station buildings. While there is clear crossover between these two areas, there is no single rating system that exists to rate both. Therefore two rating tools have been identified to deliver these separate delivery outcomes for the Edithvale and Bonbeach projects.

The IS Rating Tool focuses on sustainability in project management, processes and triple-bottom line governance in major projects. This translates into robust consideration of climate change adaptation, improved sustainability management systems and more sustainable procurement systems.

The Green Star Rating Tool focuses on sustainability of buildings, aiming for long-term environmental benefits during operation. This largely translates into reduced operating costs and greater comfort for end users.

The IS Rating Tool

The IS Rating Tool has been developed and is managed by the Infrastructure Sustainability Council of Australia to provide a common national language for sustainability in infrastructure. The IS Rating Tool evaluates sustainability initiatives and potential environmental, social and economic impacts of major infrastructure projects throughout the project lifecycle from funding, planning, procurement, design and delivery to operations and maintenance. The rating is based on a 100-point scale, with points awarded for meeting the requirements of defined criteria in both project design, and the 'as-built' infrastructure at project completion.

Every project is required to achieve a minimum 'excellent' for both design and as-built ratings.

As the ability to achieve certain points is dependent on the unique context of each project, how the required rating is achieved is largely up to the contractor. However, LXRA does identify a number of criteria as mandatory, including the requirement for a climate change assessment to inform detailed design. This mandatory criteria of project-specific climate change assessment and identification of mitigation and adaptation techniques for construction and operation is how LXRA is addressing climate change risk for the life of the project assets.

The Green Star Rating Tool

The Green Star Rating Tool has been developed and is managed by the Green Building Council of Australia and is the only national and voluntary rating system for buildings and communities. LXRA has adopted the Melbourne Metro Rail Project Green Star Rating Tool, which assesses the sustainability outcomes from the design and construction of new and rebuilt station buildings. Similar to the IS rating tool, Green Star is a points-based tool with points awarded for meeting the requirements of defined criteria in a number of categories. Every level crossing removal project is required to achieve a minimum 'four star' rating for both design and as-built ratings. How the rating is achieved is at the discretion of the delivery partner.

What are 'design' and 'as-built' ratings?

The Edithvale and Bonbeach projects will be pursuing 'design' and 'as-built' ratings.

The **design** rating is a formal verification process based on the final design. It ensures the delivery partner is on-track to achieve an 'excellent' rating, however as designs can change during construction, is an interim rating that is superseded by the as-built rating once completed.

The **as-built** rating is the final rating achieved by each project based on the documentary evidence that proves the constructed and completed projects meet the requirements of the relevant criteria. The rating can differ from the design rating as designs can change during delivery.

10.5.5 Sustainability outcomes

LXRA is three years into an the eight-year program of works, and is achieving excellent outcomes through the application of sustainability rating tools. To date, all stations have achieved a 4-Star Green Star rating, and all projects have achieved 'excellent' or 'leading' rating under the IS Rating Tool for civil infrastructure, demonstrating that LXRA is delivering sustainability initiatives beyond industry best practice.

The Bayswater level crossings removal project is a great example of how previous projects have applied the LXRA sustainability framework to achieve excellent climate change mitigation and adaptation outcomes. Future infrastructure projects will use this framework and build upon the sustainability initiatives of earlier level crossing removals to ensure continual improvement across the Program.

Bayswater Level Crossing Removal Project – Sustainability Case Study

The removal of the level crossings at Mountain Highway and Scoresby Road, Bayswater is part of the Victorian Government's Level Crossing Removal Program to remove 50 dangerous and congested level crossings across Melbourne. In late 2015, an Alliance consisting of Laing O'Rourke, Fulton Hogan, AECOM, the Level Crossing Removal Authority, VicRoads, Public Transport Victoria and Metro Trains Melbourne formed to start construction of the $177 million Bayswater Level Crossing Removal Project (LCRP).
The project included:

- lowering the rail line and raising the road at Mountain Highway and Scoresby Road
- rebuilding Bayswater Train Station and creating a new forecourt and public area
- reconstructing the bus interchange and train station car park
- constructing a grade-separated shared-use path
- modifying the streetscape along Mountain Highway.

To solidify the commitment to sustainability, generate ownership and a focus for sustainability across the project team, LXRA introduced a key result area (KRA) for sustainability. To formalise this process, the Alliance pledged to create a culture of sustainability and achieve tangible sustainability performance recognised by the Infrastructure Sustainability (IS) and Green Star Rating schemes.

The project team's actions to help create a culture of sustainability and take a broader more holistic approach with the sustainability rating tools helped the project find sustainable solutions that provided direct environmental, social, and economic benefits to the project and local community. Figure 10.3 shows a snapshot of the project's sustainability performance.

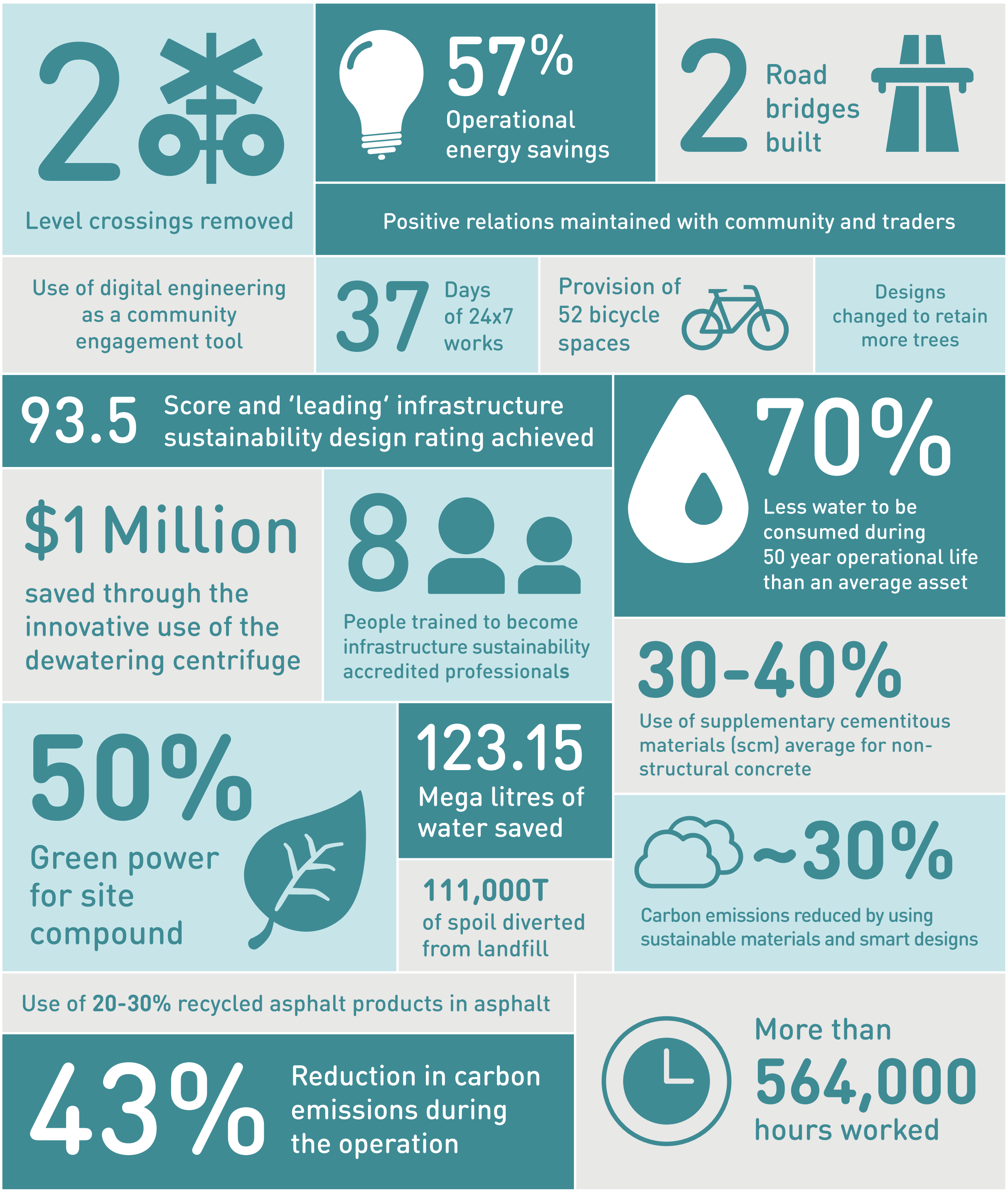
Environmental performance indicators were used to measure energy usage, carbon emissions, water consumption, waste, lifecycle impacts of materials and discharges to land, air and water. The Alliance established many sustainability initiatives to generate a reduction in the project's energy and carbon footprint to ensure operational efficiency of infrastructure assets while changing the way we work. Examples include project wide LED lighting, altered rail track alignment, use of high performing sustainable materials, and use of a dewatering centrifuge unit that separates water from solids in order to reduce water consumption.

The sustainability initiatives delivered on this project helped to debunk many myths surrounding the ability to achieve sustainable outcomes on major transport infrastructure projects. The sustainability team was able to prove that sustainable initiatives, methods and alternative materials were cost effective. By exploring financial paybacks on sustainable initiatives introduced in design and engineering, and by better understanding capabilities and services within the supply chain, the team learnt there are many cost effective, untapped sustainable solutions and innovations available in the market. The use of a dewatering centrifuge unit is an excellent example of an initiative which had an economic and environmental driver associated with reducing waste volumes and reusing clean water generated in waste fluids.

Engagement with the community and local stakeholders helped the project team understand their needs and prioritise key issues. Listening to the concerns and opportunities of commuters and other stakeholders, the design team was able to provide smart solutions to improve safety for commuters, access and inclusion of people living with a disability, flow of transport and community connectivity. During construction, the project team engaged with the community to answer questions about the design using innovative digital engineering technology. By engaging with the community and listening to their needs, the Alliance was able to construct a productive and open environment for the community.

The Bayswater Level Crossing Removal Project was the first project completed under the Level Crossing Removal Program certified with a sustainability rating. The project received a 'leading' IS design rating with an unprecedented score of 93.5 out of 100 and has set a new benchmark in sustainable delivery for the rest of the industry to follow.

Figure 10.3 Bayswater level crossing removal project sustainability outcomes



2 Level crossings removed

57% Operational energy savings

2 Road bridges built

Positive relations maintained with community and traders

Use of digital engineering as a community engagement tool

37 Days of 24x7 works

Provision of 52 bicycle spaces

Designs changed to retain more trees

93.5 Score and 'leading' infrastructure sustainability design rating achieved

70% Less water to be consumed during 50 year operational life than an average asset

$1 Million saved through the innovative use of the dewatering centrifuge

8 People trained to become infrastructure sustainability accredited professionals

30-40% Use of supplementary cementitous materials (scm) average for non-structural concrete

50% Green power for site compound

123.15 Mega litres of water saved

111,000T of spoil diverted from landfill

~30% Carbon emissions reduced by using sustainable materials and smart designs

Use of **20-30%** recycled asphalt products in asphalt

43% Reduction in carbon emissions during the operation

More than **564,000** hours worked

10.6 Integrating climate change in the impact assessment process

A changing climate is placing ecosystems, property, communities and infrastructure assets under increasing physical risk. Consideration of climate change is of critical importance when assessing immediate and long-term potential environmental effects of a major infrastructure project.

In the coastal areas around Port Phillip Bay, the risk from climate change is attributable to observed and predicted intensification of rainfall and storm events, lower average rainfall, sea level rise, storm surge, coastal erosion, and increased average temperatures and extreme heat events. While some impacts may be assessed as low risk and low magnitude during the first 20 years of operation, the same impact may be exacerbated by climate change on a 50 to 100 year time scale.

As such, the EES has included climate change risk and modelling in both the groundwater and surface water assessments, as set out below, using the best and most recent climate change modelling data for the Port Phillip region. While the EES assessments cover a broad array of climate variables (rainfall intensity, evaporation and sea level rise), other key climate risk variables (greenhouse gas emission reduction, extreme heat, etc.) are addressed through the ISCA and Green Star rating tools, as well as the Urban Design Framework which considers thermal comfort and urban amenity. This is done during early design, construction and operation in order for climate risks to be identified and incorporated into construction and ongoing operation of the rail infrastructure.

10.6.1 Uncertainty in climate change scenarios

It is acknowledged that there still remains a high degree of uncertainty regarding Victoria's climate future. However, the EES process, and consequent project delivery would use the most up-to-date scientific guidance provided in the *Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria* (DELWP, 2016) and the *Planning for Sea Level Rise Guidelines* (Melbourne Water, 2017) in order to best manage this uncertainty (EPR reference SS2).

10.6.2 Climate change in groundwater impact assessment

As described in Chapter 5 *Modelling the water environment*, a numerical groundwater model was developed using available data to predict potential effects for a range of aspects including climate change on the regional groundwater regime as a result of the proposed rail trenches.

The model utilised the Department of Environment, Land, Water and Planning (DELWP) *Guidelines for Assessing the Impact of Climate Change on Water Supplies in Victoria 2016* to ensure that the outputs of the model take into account predicted effects of climate change on groundwater resources (EPR reference SS2). The guidelines provide the most up-to-date climate science projections, and describe:

- the major influences on Victoria's climate and how these have changed over recent decades
- the future climate and runoff projections for Victoria under increased greenhouse gas emissions
- how the future climate, recharge and runoff projections can be applied for water planning.

The groundwater model was calibrated with climate data from the past 20 years (commencing in January 1997), covering a period of extreme climatic conditions that includes the Millennium Drought and conditions of above average rainfall from 2010 to 2011. The same climate data was used for forward predictions, to assess the impacts of the level crossing removal projects under a range of climatic conditions, with the following modifications to account for climate change effects:

- a 0.8m increase in sea level, estimated by increasing the coastal (and tidal) boundary heads
- a reduction in recharge to unconfined aquifers of 52.8 per cent by 2065, as per the high climate change impact scenario for the catchment.

It was found that the climate change effects do not exacerbate the potential impacts to groundwater associated with the proposed construction methods of the Edithvale and Bonbeach projects. This is because higher sea level and reduced recharge further inland result in less groundwater flow from land to sea. This in turn reduces the net effect of groundwater mounding and drawdown because of the proposed trenches. These results are detailed in EES Technical Report A *Groundwater*.

10.6.3 Climate change in surface water impact assessment

New rail infrastructure associated with the Edithvale and Bonbeach level crossings should be designed to be resilient to the impacts of climate change, including both sea level rise and storm intensity. As such, the assessment draws on the Planning for Sea Level Rise Guidelines (Melbourne Water, 2017) that applies to development proposals in areas that will be affected by tidal inundation (including storm surge and wave action). The guidelines provide the most up-to-date climate science projections, and describe:

- how the effects of sea level rise from climate change are to be included within design cases
- how the planning benchmarks for sea level rise established for Victoria should be applied to different development types
- the predicted future flood levels for Port Phillip Bay and Western Port.

For more information and visuals of predicted sea level rise and storm intensity in the Port Phillip and Westernport regions, visit the Planning for Sea Level Rise Guidelines (Melbourne Water, 2017) at <www.melbournewater.com.au/sites/default/files/Planning-for-sea-levels.pdf>.

Using the Planning for Sea Level Rise Guidelines (Melbourne Water, 2017) the surface water assessment has considered:

- a rise in sea level of 0.8 metres, which is the expected increase resulting from climate change by 2100
- continued increases in global greenhouse gas emissions leading to an increase in the frequency and intensity of extreme weather events
- most significantly, a 19 per cent increase in rainfall intensity predicted by Australian Rainfall & Runoff.

It has been found that while increased rainfall intensities would increase nearby flood levels, they would not significantly affect flow paths at either Bonbeach or Edithvale project sites to the extent that they would interact with the rail corridor. However, as the trenches would collect the rain water that falls in it, the stormwater management systems would be designed to consider future rainfall volumes through the engineering design solution described in Technical Report A *Groundwater* and Chapter 2 *Rationale and project descriptions*. This will enable the continued operation of the railway while not adversely affecting local flooding if the stormwater is discharged to the local drainage network.

10.7 Sustainability knowledge sharing

LXRA facilitates a sustainability coordination committee, comprised of sustainability representatives from all delivery partners and industry stakeholders. The committee captures learnings and innovations from previous level crossing removal projects in order to improve delivery of future level crossing removal projects. As Edithvale and Bonbeach are two of the last projects in the 50 Level Crossing Removal Program, with construction due to commence in 2019, they stand to benefit greatly from the knowledge sharing process.

Benefits of knowledge sharing include:

- learning from existing projects within the level crossing removal program
- contributing 'lessons learned' for future sustainable infrastructure projects
- being involved with the development of new and improved versions of the Infrastructure Sustainability and Green Star rating tools.

11 URBAN DESIGN APPROACH

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11.1 Introduction

Urban design is the practice of shaping the built environment to improve the quality and overall liveability of cities and suburbs. While it considers development within a landscape context, it also considers how people engage with the physical places around them.

Achieving high-quality urban design is a long term and collaborative process that strives to create integrated, useful, attractive, safe, environmentally sustainable and socially equitable places that benefit local communities and Melbourne as a whole. Urban design excellence brings together practitioners across the transport, planning, architecture, landscape architecture, engineering and financial disciplines, together with local and state government stakeholders and the wider community.

This chapter provides an overview of how the Level Crossing Removal Authority (LXRA) achieves urban design excellence through a robust, program-wide process, and how this approach would provide for sensitive, responsive and engaged designs for both the Edithvale and Bonbeach level crossing removal projects. This chapter should be read in conjunction with Version 3 of the Urban Design Framework (UDF) (provided in Attachment IV *LXRA corporate policies*), the draft Edithvale Urban Design Guidelines (UDG) and the draft Bonbeach UDG, provided in Attachment VI *Draft Edithvale Urban Design Guidelines* and Attachment VII *Draft Bonbeach Urban Design Guidelines*, respectively.

11.2 Urban design and the Environment Effects Statement

Section 3.3 of the Environment Effects Statement (EES) Scoping Requirements (released September 2017) states that:

> *'the EES, to the extent practicable, should detail the … approach to be taken towards urban design guidelines that would be utilised to minimise visual and landscape impacts and contribute positively to neighbourhood character.'*

This chapter responds to the Scoping Requirements and details the urban design approach for the projects. This approach has guided the development of draft UDGs for the projects which enable LXRA to deliver high-quality urban design outcomes and demonstrate how the projects would respond to, and mitigate, specific risks (EPR reference UD1 and UD2) identified as part of the EES process. As such, UDGs form part of the Environmental Performance Requirements (EPRs) which can be found in Chapter 9 *Environmental Management Framework*.

The projects, through detailed design, would comply with the UDGs and provide for the following urban design outcomes:

- strengthening local neighbourhood character, including the coastal landscape
- improving connectivity to the stations
- minimising visual impact
- providing universally accessible design and improving user comfort.

During construction, the installation of hoardings should be used to minimise visual construction impacts and comply with LXRA's hoarding requirements (EPR reference UD2).

The UDGs are also referenced in EPRs relating to environmental impacts associated with ecology, historic heritage, traffic and landscape and visual impacts, further discussed in Chapter 8 *Potential local impacts at Edithvale and Bonbeach.*

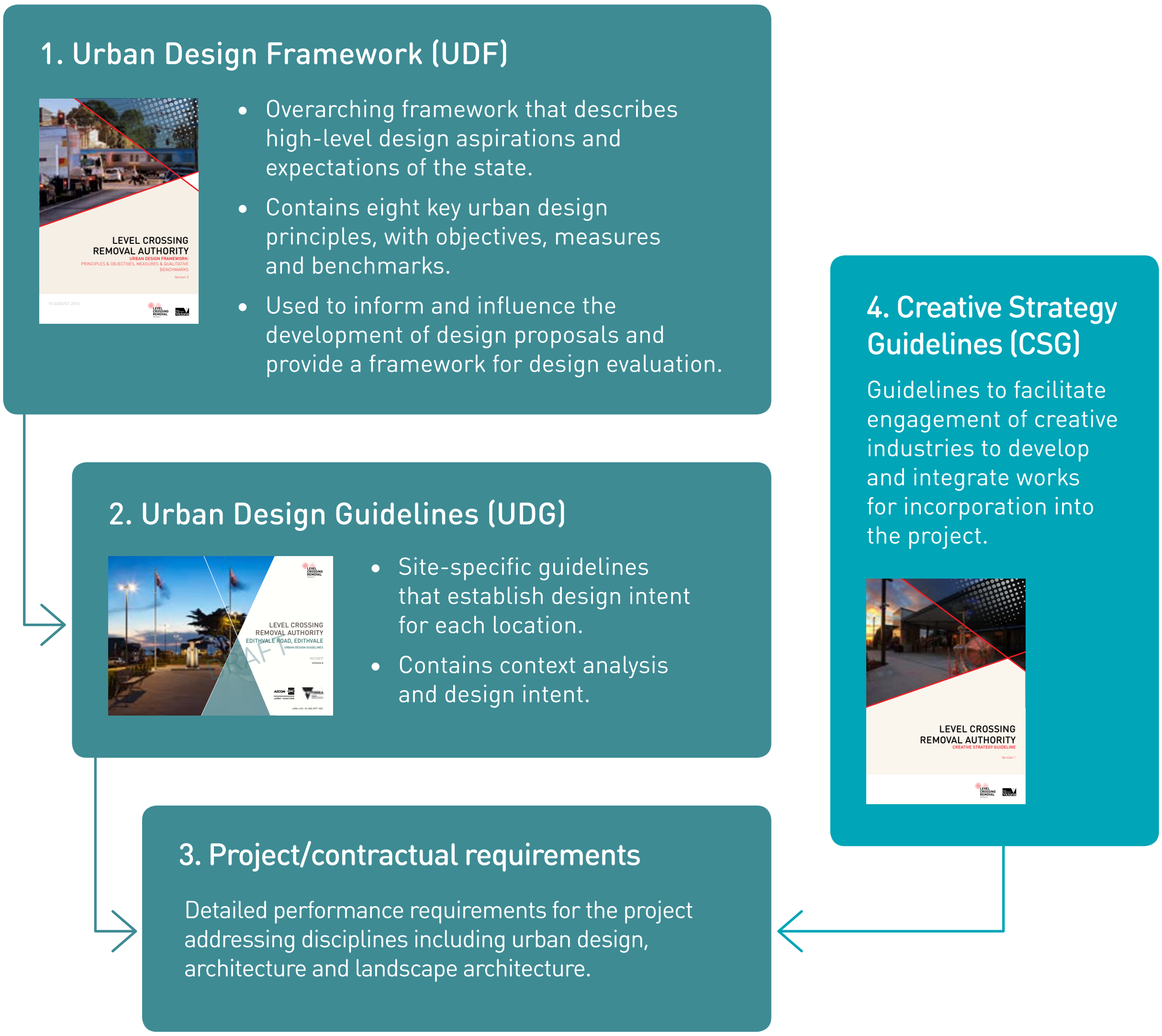
11.3 LXRA's approach to urban design

LXRA has program-wide policies and processes that guide how urban design is considered, developed and delivered for each level crossing project across the entire Level Crossing Removal Program, as well as the Mernda Rail Extension Project, the Hurstbridge Rail Line Upgrade and the Kananook Train Storage Facility Project.

These overarching policies guide the design of all projects to provide high-quality, context sensitive urban design outcomes that contribute positively to their local surrounds.

LXRA utilises the process shown in Figure 11.1 to deliver high quality urban design outcomes.

Figure 11.1 LXRA's Urban design process



1. Urban Design Framework (UDF)

- Overarching framework that describes high-level design aspirations and expectations of the state.
- Contains eight key urban design principles, with objectives, measures and benchmarks.
- Used to inform and influence the development of design proposals and provide a framework for design evaluation.

2. Urban Design Guidelines (UDG)

- Site-specific guidelines that establish design intent for each location.
- Contains context analysis and design intent.

3. Project/contractual requirements

Detailed performance requirements for the project addressing disciplines including urban design, architecture and landscape architecture.

4. Creative Strategy Guidelines (CSG)

Guidelines to facilitate engagement of creative industries to develop and integrate works for incorporation into the project.

The UDF is LXRA's program-wide framework that outlines the urban design approach, and guides the development of site specific urban design responses in the form of a UDG. The UDGs are then formalised through project requirements.

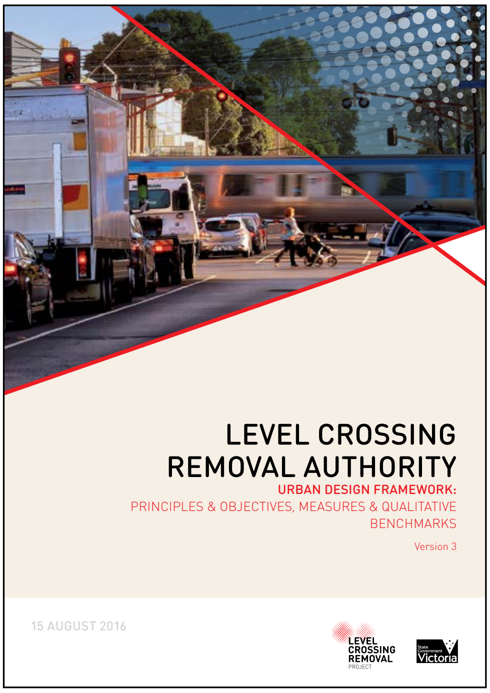
11.3.1 Urban Design Framework

The UDF sets out LXRA's expectations for how every level crossing project would achieve high-quality, context-sensitive urban design. The UDF, shown in Figure 11.2 guides each individual project through the concept, design and delivery stages, and provides LXRA with an important tool to evaluate project design.

Drawing from a program vision and design aspirations, the UDF identifies eight key principles that all projects must consider during design. Each principle contains a number of objectives that provide more specific outcomes that each project should achieve and gives effects to the principles.

Performance measures and benchmarks are also identified in the UDF. They describe more specific requirements that the design must meet and include qualitative benchmark examples that illustrate the level of quality, materials and finishes that are expected.

Figure 11.2 LXRA UDF



LEVEL CROSSING
REMOVAL AUTHORITY
URBAN DESIGN FRAMEWORK:
PRINCIPLES & OBJECTIVES, MEASURES & QUALITATIVE BENCHMARKS
Version 3

15 AUGUST 2016

Design aspirations

The UDF is underpinned by aspirations that seek to:

- achieve urban design excellence that benefits all of the transport network, its users and the communities and places through which the project passes
- maximise positive impacts and minimise negative impacts resulting from the project
- provide thorough integration of high-quality urban design with best-practice technical solutions
- develop collaborative, multi-disciplinary, integrated design for the project through an urban design led process.

Principles and objectives

The UDF identifies eight key principles that guide the 50 level crossing removal projects that comprise the LXRP together with LXRA's other rail projects. These principles are listed in Figure 11.3.

These key principles are derived from *Creating Places for People – An Urban Design Protocol for Australian Cities*. The principles are supported by objectives that outline more specific outcomes to be achieved, and give effect to each principle.

Measures and qualitative benchmarks

Recognising common project elements, the UDF includes a set of performance measures to assist in achieving the objectives and principles. Across the LXRP and other rail projects, urban design considers, as relevant:

- whole of project
- train stations
- bridges and elevated structures
- open cuttings
- public realm and built environment
- environmental sustainable design
- landscape and natural environment
- pedestrian and bicycle connections
- material and finishes
- noise attenuation
- lighting
- integrated public artworks
- integrated development opportunities.

The inclusion of the performance measures allows for the benchmarking of common design elements across the LXRP.

11.3.2 Urban Design Guidelines

UDGs are produced for each project within the LXRP, and apply the program-wide UDF to site-specific and project contexts. The UDGs, as both a process and outcome, facilitate innovative urban design outcomes and ensure that the delivery of LXRA projects result in positive urban design.

The UDGs aid in achieving urban design objectives by:

- identifying opportunities for improved connectivity, amenity, functionality and place-making with the local context and the wider urban precinct
- articulating the broader urban design vision and intents for the site
- establishing the project guidelines relating to the eight urban design principles defined in Figure 11.3 ensuring that each project design improves urban amenity through a high-quality design that responds to and is relevant for each site.

Figure 11.3 LXRA's urban design principles

Principle 1 – IDENTITY

A well defined identity and sense of place are key to creating strong and vibrant communities.

Principle 2 – CONNECTIVITY & WAYFINDING

Well connected and legible places contribute significantly to strong economies and healthy, inclusive communities.

Principle 3 – URBAN INTEGRATION

Well-integrated environments provide a sound framework for the successful development of great places.

Principle 4 – RESILIENCE & SUSTAINABILITY

Places must be sustainable, enduring and resilient in order to support and nurture current and future generations.

Principle 5 – AMENITY

High quality urban amenity associated with access to services and the experience of great public places contributes to successful, equitable and prosperous communities.

Principle 6 – VIBRANCY

Animation of key civic spaces, and diversity in the experience of urban places support prosperous and healthy communities.

Principle 7 – SAFETY

Safe environments are essential for strong, connected and happy communities.

Principle 8 – ACCESSIBILITY

Highly accessible and inclusive environments encourage positive activation and contribute to prosperity, wellbeing and the perception of care within communities.

Case Study: Burke Road Level Crossing Removal Project

The Burke Road Level Crossing Removal Project (the Burke Road Project) was completed in August 2016, and was the first level crossing to be removed as part of the Level Crossing Removal Program. The Burke Road Project urban design reflects a preliminary approach which has matured into the LXRA UDF and Urban Design Advisory Panel processes.

During the design of the Burke Road Project, the urban design process identified the Gardiner Station Signal Box as having both local heritage significance as well as being important to the local community.

Through an integrated urban design response, the signal box was retained within the train station context and repurposed as a bicycle storage facility.

This adaptive reuse of a locally significant building preserves the public transport function of the building, restores the condition of the building fabric, provides additional public facilities to encourage active transport and contributes to the use of the train station as a transport mode interchange.

As a successful example of high-quality urban design, the Gardiner Station Signal Box achieves multiple functional and design outcomes that contribute positively to the public realm and urban fabric.

11.3.3 Urban Design Advisory Panel

LXRA has established an Urban Design Advisory Panel (UDAP) to provide design advice and undertake incremental review of project design. UDAP facilitates workshops throughout the project lifecycle, and provides a forum within which the analysis and assumptions of the draft UDGs and project design can be tested. As a collaborative exercise, this ensures that the UDGs and project designs have properly considered a range of technical, policy and stakeholder matters.

UDAP's role is to guide and provide advice with respect to:

- testing and providing feedback for the development of UDGs including vision statements, urban context/design reports and reference designs/project proposals
- development of project briefs and urban design performance requirements
- development of concept designs
- evaluation of design proposals.

UDAP is chaired by a representative of the Office of the Victorian Government Architect (OVGA) and brings together a range of Victorian and local government stakeholders. These stakeholders ensure that the testing and development of the UDGs have considered architecture, urban design, landscape design, strategic planning, transport planning and Victorian and local government policies. The membership of UDAP is responsive to the specific context of each project. For the Edithvale and Bonbeach projects, there is a single UDAP that is comprised of representatives from:

- Office of the Victorian Government Architect (OVGA)
- Department of Land, Water, Planning and Environment (DELWP)
- Kingston City Council
- LXRA
- Metro Trains Melbourne (MTM)
- Public Transport Victoria (PTV)
- Transport for Victoria (TfV)
- Victorian Planning Authority (VPA)
- Other members as appropriate.

11.4 Edithvale and Bonbeach Urban Design Guidelines

The Draft Edithvale UDG and Draft Bonbeach UDG are project specific responses to the UDF and ensure that LXRA can deliver high-quality urban design outcomes.

The draft UDGs presented in the EES include:

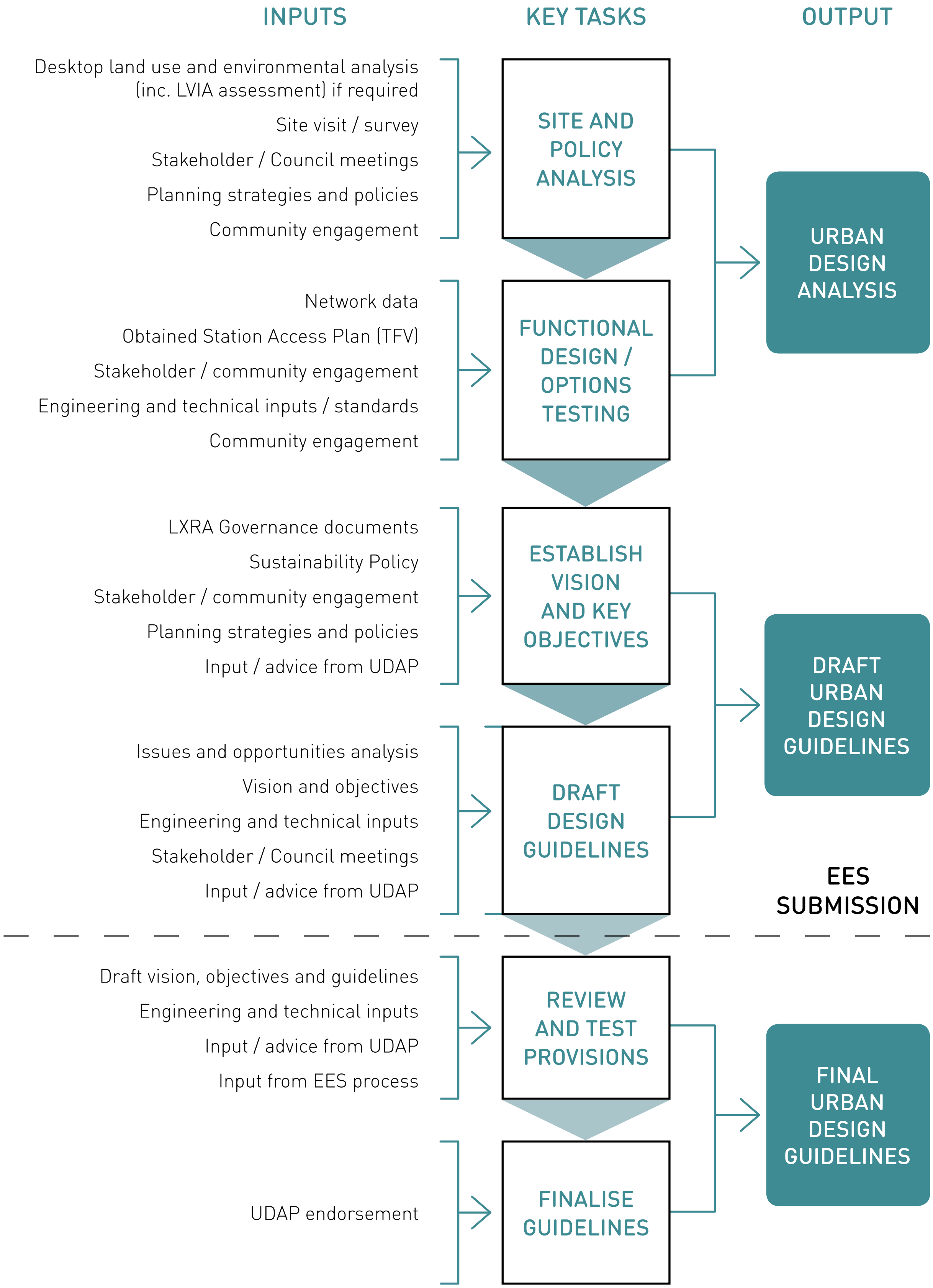
- an analysis of the site
- an analysis of strategic planning and policy contexts
- a summary of community and stakeholder engagement relevant to urban design
- urban design issues and opportunities for the projects
- guidelines for site-specific requirements for detailed design.

The draft UDGs have been informed by the analysis and consultation done so far, have been reviewed by UDAP, and would continue to be developed following the outcome of the EES process, taking consideration of any relevant recommendations.

11.4.1 Developing the Urban Design Guidelines

The UDGs are the result of a multi-staged analysis process which is informed by a number of technical, strategic, functional, stakeholder and community inputs. This process is shown below in Figure 11.4.

Figure 11.4 Development of urban design guidelines


INPUTS
KEY TASKS
OUTPUT
Desktop land use and environmental analysis (inc. LVIA assessment) if required
Site visit / survey
Stakeholder / Council meetings
Planning strategies and policies
Community engagement
SITE AND POLICY ANALYSIS
Network data
Obtained Station Access Plan (TFV)
Stakeholder / community engagement
Engineering and technical inputs / standards
Community engagement
FUNCTIONAL DESIGN / OPTIONS TESTING
URBAN DESIGN ANALYSIS
LXRA Governance documents
Sustainability Policy
Stakeholder / community engagement
Planning strategies and policies
Input / advice from UDAP
ESTABLISH VISION AND KEY OBJECTIVES
Issues and opportunities analysis
Vision and objectives
Engineering and technical inputs
Stakeholder / Council meetings
Input / advice from UDAP
DRAFT DESIGN GUIDELINES
DRAFT URBAN DESIGN GUIDELINES
EES SUBMISSION
Draft vision, objectives and guidelines
Engineering and technical inputs
Input / advice from UDAP
Input from EES process
REVIEW AND TEST PROVISIONS
UDAP endorsement
FINALISE GUIDELINES
FINAL URBAN DESIGN GUIDELINES

Site and policy analysis

To provide project and site-specific urban design responses, the UDGs assess the existing landscape and urban environment. This assessment includes site visits, desktop analyses and stakeholder and community engagement to understand the issues and opportunities that arise from the existing built context and natural environment.

The UDGs have also undertaken an analysis of strategic and policy directions, including Victorian and local government policies, network plans and strategies, demographics and trends, together with the State Planning Policy Framework and the Local Planning Policy Framework from the relevant planning scheme. This analysis ensures that the UDGs have properly considered relevant strategic matters (such as demographic trends) in providing for a high-quality urban design outcome.

The analysis undertaken has been tested through UDAP and forms Chapter 2 and 3 of the draft UDGs. The analysis should be read in conjunction with the following technical reports:

- Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*
- Technical Report D *Ecology: Project Areas*
- Technical Report F *Land Use*
- Technical Report J *Landscape and Visual*
- Technical Report N *Historic Heritage.*

Community and stakeholder engagement

To ensure that the design of the projects responds to, and has considered, public transport users and community needs, the UDGs have been informed by community workshops and consultation.

At a community workshop held on 14 September 2017, urban design was discussed for the projects. The workshop was open to all community members and was widely promoted. The workshop engaged the respective local communities about their future train station precincts. Participants were asked to provide feedback on how each existing station precinct could be improved.

Subsequent to the September 2017 workshop, LXRA sought further comment on project design through the Your Level Crossings websites.

Through consultation, the projects have identified the following themes as important to their respective communities:

- The importance and value of landscape character and further enhancement along the whole of the rail corridor
- The desire to balance user needs so that all users and all transport modes are catered for equitably to ensure that the solution benefits a broad cross section of the community
- The need for the design and materials to respond to and reflect the valued natural coastal setting and emerging architecture.

This feedback has been considered and forms part of the draft UDGs. Refer to Chapter 12 *Stakeholder and community engagement* for further detail.

Urban design vision statements for Edithvale and Bonbeach

'The Edithvale Road, Edithvale Level Crossing Removal Project will create a high quality and lasting local landmark that will strengthen the coastal and landscape character of the rail corridor and enhance the attractiveness of the Edithvale Neighbourhood Centre.

Once complete, the project will enhance surrounding public spaces by improving walking and cycling connections and other transport access.' – Edithvale UDG Vision.

'The Station Street/Bondi Road, Bonbeach Level Crossing Removal Project will create a high quality and lasting local landmark that will strengthen the landscape character of the rail corridor.

Upon completion, the project will connect the surrounding public spaces, enhance the attractiveness of the Bonbeach Neighbourhood Centre, and improve transport access and amenity across Bonbeach.' – Bonbeach UDG Vision.

Vision through to guidelines

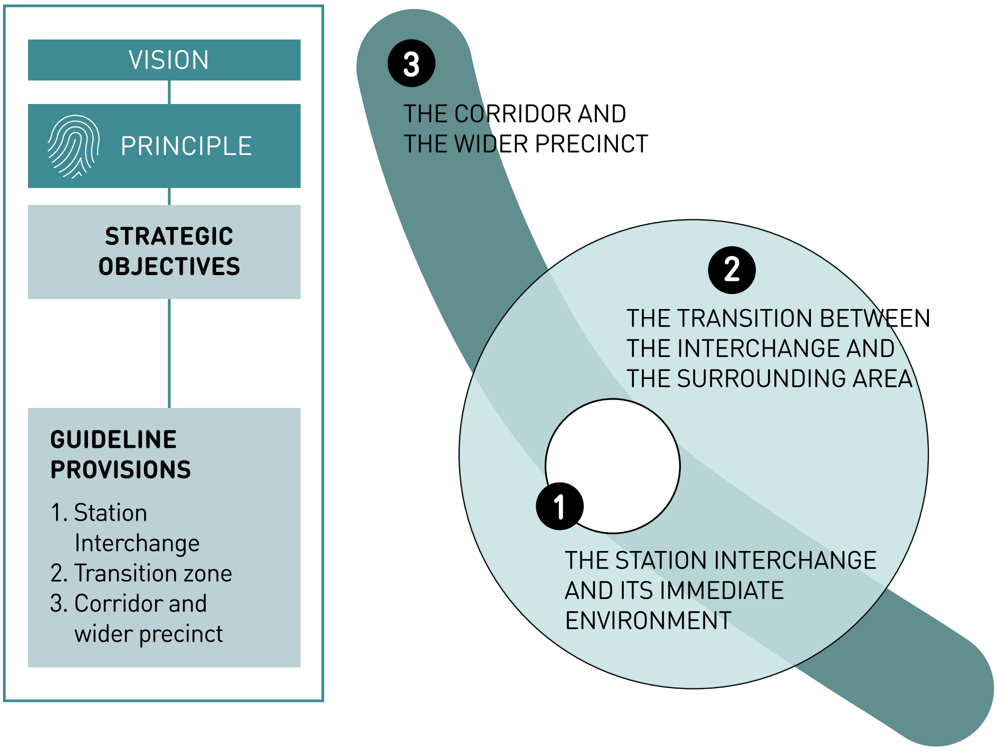
Once the site analysis and policy analysis has been completed, and the stakeholder and community engagement has commenced, the urban design process is able to begin developing a vision statement for the project. The vision statement provides an aspirational urban design outcome that is refined through the eight key principles, strategic objectives and finally, guidelines. These guidelines ensure that as projects progress through detailed design, that urban design remains part of core project considerations and provide LXRA with a tool to ensure that project design would achieve high-quality outcomes.

Considering how the projects are located and informed by their local environments, and the way in which each project forms a component of the wider metropolitan rail network, the guidelines address three urban contexts for the project:

- the station, station forecourt, entrance and public transport facilities (called an 'interchange') and its immediate environment
- the transition between the interchange and the surrounding area
- the corridor and the wider precinct.

These components and contexts of the UDGs are shown in Figure 11.5.

Figure 11.5 UDG structure and contexts


VISION
PRINCIPLE
STRATEGIC OBJECTIVES
GUIDELINE PROVISIONS
1. Station Interchange
2. Transition zone
3. Corridor and wider precinct
3
THE CORRIDOR AND THE WIDER PRECINCT
2
THE TRANSITION BETWEEN THE INTERCHANGE AND THE SURROUNDING AREA
1
THE STATION INTERCHANGE AND ITS IMMEDIATE ENVIRONMENT

CYCLISTS DISMOUNT
DO NOT CROSS WHILE LIGHTS ARE DISPLAYED OR ALARM SOUNDING 2 TRACKS
CROSSING FAULTS PHONE 1800 001050 QUOTE F0317

11.5 Design Guidelines

The draft UDGs respond to all eight principles in the UDF, and are arranged in five thematic groupings. Each of these principles are supported by strategic objectives, and further refined by design guidelines.

Each draft UDG is the result of context-specific analysis that acknowledges, as part of the wider LXRP, the shared commonalities between public rail infrastructure projects. The following sections outline how each project would achieve the urban design principles and strategic objectives through targeted guidelines.

While each project is unique, the projects share a number of similarities in built form, urban context, design solution and strategic policy. In responding to the eight principles, the draft UDGs share many similar strategic objectives and guidelines.

11.5.1 Identity and urban integration

Identity and urban integration are key principles to achieving high-quality and site responsive urban design that has considered, and responded to, the existing built form and landscape conditions.

Edithvale project

The strategic objectives for the Edithvale project identify strengthening the local neighbourhood character, protecting and strengthening the coastal landscape, integrating the station with the neighbourhood centre and minimising visual amenity impacts, as appropriate responses to the key principles of identity and urban integration.

Responding to the issues and opportunities, the guidelines direct that the scale, materials, textures and colours of the built form respond to the low scale, modest coastal character of the surrounding area. Though there is opportunity to maintain design consistency with other elements from nearby Level Crossing Removal Programs, the built form and landscape response to Beeson Reserve is critical to addressing the central organising element of the Edithvale Neighbourhood Centre. The opportunities to reinstate or establish landscaping using coastal tree species exist within the station forecourt, along the rail corridor, and Nepean Highway and Station Street. The guidelines acknowledge that the use of high-quality public realm materials, treatments and details would provide for positive visual outcomes.

The built form and landscape component of the urban design outcome for the Edithvale project would mitigate the following identified risks:

- Ecology (risks E50, E56, E57)
- Historic Heritage (risk HH6)
- Landscape and Visual (risks LV37, LV 38, LV 40, LV 41)
- Traffic (risk T27).

Bonbeach project

Similar to the Edithvale project, the strategic objectives for the Bonbeach project identify strengthening the local neighbourhood character, protecting and strengthening the coastal landscape, integrating the station with the neighbourhood centre and minimising visual amenity impacts as appropriate responses to the key principles of identity and urban integration.

Responding to the context of the Bonbeach Station, the guidelines direct that the scale, materials, textures and colours of the built form respond to the low-scale, modest coastal character of the surrounding area. Importantly, the opportunity is identified to extend elements of the project's design (particularly landscaping), into local streets that integrates with key elements of the existing coastal identity. The guidelines acknowledge that the use of high-quality public realm materials, treatments and details would provide for positive visual outcomes.

The built form and landscape component of the urban design outcome for the Bonbeach project would mitigate the following identified risks:

- Ecology (risks E50, E56, E57)
- Landscape and Visual (risks LV37, LV 38, LV 40, LV 41)
- Traffic (risk T27).

11.5.2 Connectivity, wayfinding and accessibility

Connectivity, wayfinding and accessibility relate to how projects integrate and improve existing pedestrian and bicycle infrastructure and provide for intuitive, navigable and easy to understand places that are inclusive and universally accessible. High-quality urban design outcomes encourage active transport and improve connectivity across and along the rail corridor.

Edithvale project

The strategic objectives for the Edithvale project identify the improvement of connectivity to and from the station as key to encouraging active transport modes. The design and location of the station and facilities would provide for a universally-accessible design.

Responding to the project context within the Edithvale neighbourhood activity centre, the guidelines direct the provision of dedicated walking and cycling infrastructure to the station and along and across the rail corridor. The provision of bicycle parking in visible and accessible locations in close proximity to the station would encourage access to the station via bicycle. To ensure the project is universally accessible, the location and width of car parking, bus bays and pedestrian overpasses would be designed to achieve *Disability Discrimination Act 1992* (DDA) compliance. The guidelines identify that sightlines to Beeson Reserve and the foreshore be maintained and enhanced.

The connectivity, wayfinding and accessibility components of the Edithvale project would provide for a high-quality urban design outcome that improves upon the existing conditions, encourage active transport modes, and would mitigate the following identified risks:

- Landscape and Visual (risk LV41)
- Traffic (risk T27).

Bonbeach project

The strategic objectives for the Bonbeach project identify the improvement of connectivity to and from the station as key to encourage active transport modes. The design and location of the station and facilities would provide for a universally accessible design.

Similar to the Edithvale project, the guidelines direct the provision of dedicated walking and cycling infrastructure to the station and along and across the rail corridor. The provision of bicycle parking in visible and accessible locations would encourage access to the station via active transport modes. To ensure the project is universally accessible, the location and width of car parking, bus bays and pedestrian overpasses would be designed to achieve DDA compliance. The legibility of the public space and project would be enhanced through the provision of clear, intuitive and suitably wide paths and through a design that maintains and enhances sightlines through to the foreshore.

The connectivity, wayfinding and accessibility components of the Bonbeach project would provide for a high-quality urban design outcome that improves existing conditions and encourages active transport modes within a universally accessible context, and would mitigate the following identified risks:

- Landscape and Visual (risk LV41)
- Traffic (risk T27).

11.5.3 Amenity and safety

Safety and amenity relate to how projects provide for a safe and comfortable experience of public transport infrastructure and in the public realm. These principles recognise that public transport users need to feel safe and secure within and close to stations, and conversely, that projects minimise opportunities for unsafe spaces, excessive light spill and opportunities for graffiti. High-quality urban design outcomes would provide for appropriate levels of passive surveillance, weather cover, visual connectivity and minimise impacts on adjoining properties

Edithvale project

The strategic objectives for the Edithvale project identify the improvement of user comfort and the enhancement of sense of safety as the measure of high-quality urban design outcomes.

The guidelines respond to the rail trench design of the Edithvale project, particularly with regards to ensuring that the platform environment is well-lit and provides for appropriate weather protection, as well as directing that there be opportunity for passive surveillance from the street level onto the platforms. The careful consideration of the built form of pedestrian overpasses would provide a high level of visibility for users of overpasses.

A high-quality, amenable and safe urban design outcome would feel safe for both users of the station and the local community, as well as providing a comfortable user experience. This would mitigate the following identified risks:

- Landscape and Visual (risk LV37)
- Traffic (risk T27).

Bonbeach project

The strategic objectives for the Bonbeach project identify the improvement of user comfort and the enhancement of sense of safety as the measure of high-quality urban design outcome.

Similar to the Edithvale project, the guidelines respond to the rail trench design of the Bonbeach project and pay particular attention to the platform environment. The guidelines direct that the platform be well-lit and appropriately sheltered from the weather, and acknowledge the opportunities for passive surveillance from street level. Similarly, the design and detail of pedestrian overpasses would provide a high level of visibility for users of overpasses.

A high-quality, amenable and safe urban design outcome would feel safe for both users of the station and the community in which the project is located, as well as providing a comfortable user experience. This would mitigate the following identified risks:

- Landscape and Visual (risk LV37)
- Traffic (risk T27).

11.5.4 Vibrancy

Vibrancy relates to how projects respond to and enhance the public realm and assist in activating key spaces. This principle recognises that as public infrastructure, high-quality urban design outcomes would ensure that projects contribute in a meaningful and diverse manner to the social and cultural experience of local communities.

Edithvale project

The strategic objectives for the Edithvale project identify linkages and the public realm as key to ensuring that the project better integrates with the existing Edithvale Neighbourhood Activity Centre.

The guidelines respond to the local context of the Edithvale project, particularly with regards to Beeson Reserve, and direct that the location of the main station entrance maintains physical and visual links to the activity centre and key beach access points. The enhancement of pedestrian connectivity from the station to Beeson Reserve, and the response of the built form to the neighbourhood context would maximise active inter-modal spaces and contribute in a positive manner to the existing activity centre.

A high-quality and vibrant urban design outcome would mitigate the following identified risks:

- Ecology (risks E50, E56, E57)
- Historic Heritage (risk HH6)
- Landscape and Visual (risks LV37, LV 38, LV 40, LV 41)
- Traffic (risk T27).

Bonbeach project

The strategic objectives for the Bonbeach project identify the integration of the station with existing uses as key to provision of a high-quality and functional public realm.

The guidelines respond to the modest scale of the local neighbourhood uses surrounding the Bonbeach project, and direct that the location of the main station entrance maintains its current position. Enhancement of pedestrian connectivity and infrastructure from the station through to the foreshore and the existing local retail uses are identified as important, and would complement the station forecourt.

A high-quality and vibrant urban design outcome would mitigate the following identified risks:

- Ecology (risks E50, E56, E57)
- Landscape and Visual (risks LV37, LV 38, LV 40, LV 41)
- Traffic (risk T27).

11.5.5 Resilience and sustainability

Resilience and sustainability relates to how projects would provide for enduring public transport infrastructure that recognise the immediate social and environmental context, as well as responding to anticipated future requirements. High-quality urban design outcomes would employ environmentally sustainable components and design to provide for enduring infrastructure that reduces environment impact.

Edithvale project

The strategic objectives for the Edithvale project identify the promotion of sustainable and site responsive design as key to providing a lasting station precinct.

Responding to the local context of the Edithvale project, the guidelines direct that the selection of material palette be durable, low maintenance, minimise opportunity for graffiti and be resilient to the coastal setting. The landscaping response would be appropriate for the climatic and environmental conditions with appropriate plant species. The guidelines identify the importance of natural daylight to the station platforms to reduce reliance on artificial lighting.

A resilient and sustainable urban design outcome would mitigate the following identified risks:

- Ecology (risks E50, E52, E53, E54, E56, E57)
- Landscape and Visual (risks LV37, LV40, LV41).

Bonbeach project

The strategic objectives for the Bonbeach project identify the promotion of sustainable and site responsive design as key to providing a lasting station precinct.

Similar to the Edithvale project, the guidelines for the Bonbeach project direct that the material palette be durable, low-maintenance, minimise opportunity for graffiti and be resilient to the coastal setting. The landscaping response would be appropriate for the climatic and environmental conditions with appropriate plant species. The guidelines identify the importance of natural daylight to the station platforms to reduce reliance on artificial lighting.

A resilient and sustainable urban design outcome would mitigate the following identified risks:

- Ecology (risks E50, E52, E53, E54, E56, E57)
- Landscape and Visual (risks LV37, LV40, LV41).

11.6 Conclusion

LXRA has a robust process which provides for excellent urban design outcomes across the Level Crossing Removal Program. LXRA's UDAP ensures that project specific UDGs are guided by discussion with local community, key industry and Victorian and local government stakeholders, and in response to the eight principles in the UDF.

Once finalised, the UDGs provide LXRA with an assessment framework that ensures that LXRA's Alliance partners and detailed project design respond to the UDF and UDGs, and deliver projects that make great places, and which are prosperous, safe and vibrant. This approach responds to the EES Scoping Requirements as they apply to urban design.

Draft UDGs have been developed for both the Edithvale and Bonbeach projects, and provide clear direction as to the manner in which the landscape and built form for each project respond to the identified issues and opportunities. LXRA would continue to develop the UDGs once the EES process has been completed, and would work together with the community and stakeholders to provide excellent urban design outcomes.

12 COMMUNITY AND STAKEHOLDER ENGAGEMENT

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12.1 Introduction

Stakeholder and community engagement has played an important role in developing and shaping the Edithvale and Bonbeach level crossing removal projects.

LXRA recognises public participation provides the best project outcomes. As such, LXRA has undertaken an extensive engagement program to ensure the Edithvale and Bonbeach communities and stakeholders with an interest, or those expected to be affected, are informed, involved and able to actively contribute to the development of the projects.

LXRA has undertaken market research that demonstrates strong awareness and support for the projects, with many recognising the travel, safety and community benefits that come from removing level crossings.

This chapter summarises the stakeholder and community engagement activities, and findings, for the Edithvale and Bonbeach level crossing removal projects over the past two years. It also steps out the approach for ongoing engagement during construction.

12.2 Consultation framework

LXRA undertook consultation during the early investigations, options assessment and design development stages of the projects (see Figure 12.1). The early investigations and options assessment phases of engagement helped LXRA to understand concerns and opportunities, ultimately resulting in a preference for trench solutions.

The primary focus of the EES is to assess potential environmental effects on regional groundwater, the Edithvale-Seaford Wetlands and the disturbance of acid sulfate soils. During the preparation of the EES, LXRA recognised the value in engaging on other key topics including design solutions, walking and cycling connections, the look and feel of the station precincts and planning and managing disruptions.

Feedback has been considered on these aspects as part of further planning and design work for each project (refer to Section 12.9). Given the stage of the project, the engagement undertaken during the preparation of the EES is referred to as the design development stage.

The EES process further provides the opportunity for a comprehensive and transparent analysis of any impacts associated with the project, including possible mitigation measures.

Scoping Requirements

The Scoping Requirements for the Edithvale and Bonbeach Level Crossing Removal Project require that:

The EES should document the process and results of consultation undertaken by LXRA during the preparation of the EES, including:

- issues raised and suggestions made by stakeholders or members of the public
- the responses then made by LXRA in the context of the EES studies or the associated consideration of mitigation measures and the draft planning scheme amendment.

The EES should also provide an outline of a program for community consultation, stakeholder engagement and communications proposed for implementation of the project, including opportunities for local stakeholders to engage with LXRA to seek responses to issues that might arise during project implementation.

LXRA developed and published a Consultation Plan at the outset of the EES process which outlines how communities and stakeholders would be informed and involved in the EES, as well as how feedback would be addressed. Outcomes from the plan are detailed in this chapter.

Figure 12.1 Community and stakeholder engagement timeline

EARLY 2016

We asked communities and stakeholders what was important to them.

LATE 2016

We sought feedback on the feasible level crossing removal options (rail bridge and rail trench) at each site.

EARLY 2017

We considered community feedback, technical feasibility and environmental considerations before selecting preferred design solutions (rail trenches).

MID-LATE 2017

We used community and stakeholder feedback to refine the designs and address project impacts as part of the EES process.

12.3 Engagement principles

LXRA recognises public participation provides the best project outcomes, and has undertaken an extensive engagement program throughout all stages of the project lifecycle.

Project engagement principles were developed with guidance from the relevant Government legislation and policies around the need for community engagement:

- the *Transport Integration Act 2010* includes the principles of stakeholder engagement and community participation in decision-making
- guidelines under the *Environment Effects Act 1978* provide formal opportunities for public engagement and the proponent's proposed plan for consultation
- *Victorian Government Accessible Communications Guidelines 2014* ensure communications materials are presented in ways that allow all Victorians to access information
- *Victorian Government Communications Guidelines 2013* ensure communications activities by Victorian Government entities are effective, well-managed and responsive to the diverse needs of the Victorian community
- the *Victorian Auditor-General's Office Public Participation in Government Decision-Making Guide 2015* provides a high-level framework for the public sector to use when deciding how best to involve the public in government decision-making and implementation.

A number of engagement principles were adopted, as established in the Victorian Auditor-General's Office Better Practice Guide for Public Participation. These principles, and LXRA's approach to each, are set out in Table 12.1.

Table 12.1 Engagement principles and LXRA approach

Principle	LXRA approach
Responsiveness	• Prompt acknowledgement of queries or concerns • Respond to all issues raised, no matter how big or small
Openness	• Be open and honest in our interactions with the public • Continue to meet with residents and stakeholders as requested
Inclusiveness	• Establish a Community Reference Group (CRG) during the formal planning phase to inform on the project and ensure community and stakeholder views are captured • Ensure materials and documents are provided in an accessible format, allowing a wide range of community members to participate
Transparency and integrity	• Provide timely updates on project progress through various communication channels • Provide information with enough time for people to understand and ask informed questions, before we ask for feedback
Accountability	• Take ownership for any issues which may arise and have an impact on residents or stakeholders • Provide key points of contact within LXRA for any community queries or concerns
Awareness	• Broad communications spanning neighbouring suburbs regarding the EES and opportunities for involvement • Use a range of communication channels to tap into different audiences i.e. online, newspapers, letterbox drops, signage, face-to-face

12.4 Engagement objectives

LXRA developed engagement objectives which were outlined in the EES Consultation Plan, published at the outset of the EES process, and revisited throughout the EES stage of engagement to ensure relevance. Communications and engagement outcomes have been evaluated against these objectives as outlined in Table 12.2.

Table 12.2 Engagement objectives

Objective	Result
Achieve a high level of awareness with local residents, businesses and stakeholders regarding the EES process and opportunities to influence outcomes	• Project newsletters were delivered to 20,000 households and businesses on two occasions during the EES phase • Business and social impact interviews assisted in generating a high level of awareness about the project, EES process and opportunities to influence outcomes (refer to Chapter 8 *Potential local impacts at Edithvale and Bonbeach*) • Telephone surveys conducted at the start of the EES phase with a random sample size of 389 (190 Edithvale and 199 Bonbeach), demonstrated a high awareness for the projects (97 per cent Edithvale and 96 per cent Bonbeach) and a moderate to high awareness about the EES (69 per cent Edithvale and 63 per cent Bonbeach). Follow up telephone surveys will be conducted after the EES has been exhibited.
Provide opportunities for community involvement in the EES process, particularly regarding any potential environmental impacts and mitigation measures	• Established a Community Reference Group (CRG) to inform interested community members and stakeholders on the project as well as provide an opportunity to raise questions and concerns • Held an Edithvale/Bonbeach community workshop on 14 September 2017 with 32 attendees • Information sessions planned for the EES Exhibition phase to help explain the EES investigations and provide access to project staff.
Encourage participation in the EES and project development	• Highlighted the EES process and future opportunities for involvement through three email updates, community newsletters to 20,000 businesses and households, 11 social media posts, as well as a video, online information and media releases • Ran two CRG meetings and participated in six Technical Reference Group (TRG) meetings with stakeholders.
Ensure communications materials are clear, accessible and easily understandable, allowing community members and stakeholders opportunities to provide comment on the draft Scoping Requirements and EES upon exhibition, if desired	• Developed collateral in print and digital formats that were easy to understand with accessible options • Project language line available to assist those requiring information in other languages • Consulted with key stakeholders, including Kingston City Council, on languages preferred among the community for the future promotion of the EES exhibition and opportunities to get involved • Consulted with community group leaders via the Kingston City Council to identify and engage with vulnerable and hard to reach communities to inform them of opportunities, such as the community workshop.
Demonstrate how community and stakeholder concerns have been addressed through the EES process	• Refer to Section 12.9.

12.5 Overview of engagement

This section provides an overview of engagement activities and outcomes undertaken in relation to the removal of the Edithvale and Bonbeach level crossings.

12.5.1 Early investigations

From February to June 2016, LXRA created opportunities for local communities and stakeholders to learn more about the projects and to share what is important to them in their local area. This engagement was targeted to people living and working alongside the Frankston line from Cheltenham to Frankston.

Specifically, the project team was keen to learn what was important for LXRA to consider in the development of level crossing removal design options. Additionally, these opportunities were used to build awareness of the projects and share information on how people could find out more and participate throughout the project development. This is summarised in Table 12.3.

Activities included community sessions, door-knocking more than 2,600 homes, distributing 20,000 flyers to local household letterboxes and a community newsletter to thousands of homes. Local media coverage was secured and 'pop-up' events were staged at train stations, shopping centres and other key locations. LXRA collected feedback through phone and email channels, hard copy feedback forms, community information sessions and an online engagement platform known as 'Social Pinpoint'.

To provide further insight on community awareness and knowledge of the projects, independent market research company EY Sweeney was engaged to conduct a survey between late May and mid-June 2016. Using a mix of face-to-face and telephone interviews, the survey (2,938 surveys undertaken) revealed that more than 80 per cent of residents, train users and businesses were in favour of the planned removal of the level crossings along the Frankston line. Reduced road congestion and increased road user and pedestrian safety were the most anticipated positive impacts; most cited potential concerns were disruption during the construction phase and visual amenity.

The feedback emerging from this phase, along with the results of technical and environmental studies, were used to explore all feasible level crossing removal options at the nominated sites along the Frankston line, with due consideration to localised interest and concerns.

Table 12.3 Summary of engagement during the early investigation phase

Method	Purpose	Result
Meetings/ Drop-in's	• Drop-ins and meetings were held with a number of key stakeholders to disseminate information, and to discuss and inform design and planning	• Drop-ins to all businesses across the Edithvale and Bonbeach shopping strips
Community pop ups and information sessions	• Pop-up events at train stations to highlight the upcoming activities and promote participation • Community information sessions to display information and maps, and to provide access to the project team and collect feedback	• 19 pop-up train station events along the Frankston line • Nine community information sessions along the Frankston line including one at the Longbeach RSL in Chelsea
Communications materials and door-knocks	• Communications collateral including flyers and project newsletters developed to highlight the project and ways to get involved • Door-knocks to residents within a 200 metre proximity to the rail line	• Along the Frankston line there were: – 2,600+ homes door-knocked – 20,000 flyers distributed to local household letterboxes – 65,000 newsletters delivered
Digital	• Social Pinpoint launched to gauge impacts and information specific to residents and business locations	• 4,090 pins dropped on Social Pinpoint
Surveys and feedback forms	• Telephone and face-to-face interviews to determine level of interest and awareness in project including benefits and issues • Feedback forms developed to capture feedback	• Along the Frankston line there were: – 2,938 residents interviewed – more than 500 responses to feedback forms received

Feedback themes

This stage of engagement highlighted high levels of support for both the Edithvale and Bonbeach projects. Both projects shared common themes including a strong interest in urban design outcomes, local access and potential noise impacts and a desire to retain the small beach village feel that makes both locations unique. Providing safe access for pedestrians from car parks to retail areas, the station and the beach also emerged as a key theme for both projects.

Edithvale key findings highlighted concerns about existing traffic congestion on the Nepean Highway and Edithvale Road and also with elevated rail. The retention of the Fraser Avenue pedestrian crossing over the rail line was a key outcome whilst there was a strong desire to protect and enhance the nearby Edithvale-Seaford Wetlands.

Key findings for Bonbeach during the early investigations showed that while many expressed support for the project, others queried the need given this location was not perceived as congested compared with other areas. Concerns were raised regarding elevated rail, the impacts to the station gardens and about illegal traffic movements in the area from motorists trying to avoid delays. Feedback also highlighted support for a road bridge crossing Patterson River connecting Station Street either side of the river.

12.5.2 Options assessment

LXRA undertook an extensive round of community and stakeholder engagement between 6 September and 30 October 2016 to gain feedback on the proposed level crossing removal options. LXRA shortlisted two feasible options for community consultation at each site – a rail trench (rail under the road) and a rail bridge (rail over the road).

LXRA alerted people to the consultation process through a multi-faceted communications campaign involving direct mailouts to households in the area, local newspaper ads, radio alerts, media releases and articles, email updates, social media posts, YouTube videos and flyers/posters at local shopping centres and train stations.

LXRA engaged with community members and stakeholders through varied methods including targeted community presentations and stakeholder meetings. Thousands of people viewed information via the project specific 'Your Level Crossings' online engagement portal that was established at the start of the engagement phase. Hundreds participated in the engagement activities and asked questions.

Shortly following the consultation process, telephone surveys were undertaken by EY Sweeney to further understand local views and concerns about the level crossing removal projects along the Frankston line. A total of 260 residents and 50 traders in Edithvale and Bonbeach were surveyed in this round.

Participants were asked to consider benefits and concerns in relation to the level crossing removal solution, as well as a range of questions relating to their awareness of the level crossing removal and views relating to the importance of different factors. Those participating also provided feedback that highlighted high levels of concern regarding the rail bridge options due to visual impact, with little benefit for being able to use the space under the rail line, such as at other sites. There were high levels of support for a trench solution with various suggestions for maintaining connections over the rail line for pedestrians.

Feedback gained from this stage of engagement, along with technical and environmental considerations, resulted in the trench design being chosen as the preferred option for level crossing removals at both locations.

Table 12.4 Summary of engagement during the options assessment phase

Method	Purpose	Result
Meetings	• One-on-one meetings were held with a number of key stakeholders to gain insight and feedback on the proposed designs.	• Met or spoke with ten key stakeholders or stakeholder groups: – Kingston City Council – Friends of Edithvale-Seaford Wetlands – Bonbeach Surf Lifesaving Club – VicRoads – No Sky Rail – Frankston Line – Noskyrail.com.au – Bicycle Network – RACV – Bus Association of Victoria – Public Transport Users Association.

Method	Purpose	Result
Community presentations and information sessions	• Presentations for those living and working close to each level crossing to: – provide locals with technical information about the level crossing removal options under consideration – inform people about the engagement process – provide an opportunity to ask questions of relevant technical experts. • Four 'drop-in' style community information sessions were held for Edithvale and Bonbeach locals, providing the opportunity for people to learn more about the project, view maps and plans, speak with members of the project team and provide direct feedback.	• Presentations were held on 14 September 2016 in Edithvale and 16 September 2016 in Bonbeach to provide technical information about the options under consideration and inform about the engagement process • Two community information sessions were held for the Edithvale project at Mordialloc Secondary College on 26 September and 8 October 2016 with 365 people attending the sessions • For the Bonbeach project, two community information sessions were held at Patterson River Golf Course on 21 September and 13 October 2016 with 345 people attending the sessions.
'Your Level Crossings' online engagement hub	• LXRA launched a new online engagement hub at the start of the consultation process called 'Your Level Crossings', providing information about the level crossing removal options through images, videos, maps, frequently asked questions and fact sheets • People could share feedback through an online survey, discussion forum and quick poll. In addition, a question and answer tool assisted with providing more information about key aspects of the project.	• 3,930 people visited the Edithvale online engagement hub providing 348 online forum comments • The Edithvale project video was viewed 7,657 times • The Bonbeach online engagement hub attracted 3,140 visits with 194 online forum comments provided • There were 9,686 views of the Bonbeach project video.
Surveys and feedback forms	• The feedback form, also replicated online forming the 'survey' section of the Your Level Crossings hub, was designed to capture both quantitative and qualitative information about: – the importance of various technical factors – perceived benefits and concerns associated with the design options under consideration – priorities for LXRA as project planning and development further progresses – satisfaction levels with the consultation process. • Participants were asked to consider benefits, concerns and improvement suggestions for the rail bridge and rail trench solutions.	• 503 survey responses were captured for the Edithvale feedback form and online survey • The Bonbeach feedback form and online survey received 320 responses.

Feedback themes

Overall, feedback indicated a strong preference for rail trench solutions at both Edithvale and Bonbeach. The main issue raised in relation to rail bridges was that the designs would have a negative visual impact on the area, given the narrow rail corridor in these areas.

While there was strong support for rail trenches, there were some concerns raised regarding this option including potential impacts to the water table and a perceived division of the suburb. Ensuring the projects would have visual amenity that appealed to the local area was considered to be the main priority for the future of the projects.

12.5.3 Design development

During the EES phase, there was a strong focus on stakeholder engagement through the project's TRG. The TRG, convened by the Department of Environment, Land, Water and Planning (DELWP), provided advice to the project team on key issues and concerns from their respective areas of interest. This ongoing engagement with councils and relevant government agencies has enabled the key issues and interests of Victorian and local government to be incorporated into the EES.

A Community Reference Group (CRG) was also formed during the EES investigations to strengthen links with the community and to share information about the EES process and outcomes. This group helped promote broader engagement activities including community workshops and one-on-one meetings. This engagement provided an understanding of the concerns and preferred outcomes of local residents, businesses and other interested parties and ensured that these were considered in the design and assessment process. Key themes from discussions included traffic impacts, managing and protecting the wetlands, business continuity and management of the construction and disruption.

In addition, LXRA met directly with local groups and stakeholders including Kingston City Council and the Friends of the Edithvale-Seaford Wetlands to gain feedback on key areas of interest, and to allow more in-depth conversations around impacts and mitigations.

LXRA undertook broad consultation during this stage to further inform the design and enhance overall project outcomes, as summarised in Table 12.5. This included meetings, briefings and workshops with communities and stakeholders to understand the issues and work collaboratively on potential mitigations, resulting in a better outcome for all involved.

Table 12.5 Summary of engagement during the design development phase

Method	Purpose	Result
Meetings (including as part of social and business impact assessments)	• One-on-one meetings were held with a number of key stakeholders to gain insight and feedback on the design, construction impacts and environmental considerations • A CRG was established with 12 members representing a diverse range of groups and opinions.	• Met with 20 business stakeholders as part of the business impact assessment • Interviewed a range of stakeholders as part of the social impact assessment • The CRG met twice (7 September and 9 November 2017) during the preparation of the EES.
Community workshops and information sessions	• A community workshop was held with three key themes that were of interest to local communities: – walking and cycling – station precinct and design – construction impacts.	• 32 people attended the community workshop held in September 2017 at the Patterson River Golf Club.
'Your level crossings' online engagement hub	• An online engagement hub featuring project information, including details about the EES process, as well as opportunities to ask questions through a Q&A tool and provide feedback through a survey was made available	• 3,300 visits to the online engagement hub during the design development phase • 35 questions asked and responded to via the Q&A tool • 173 survey responses received to the 'Have your say' survey launched following the community workshop.
Surveys and feedback forms	• Quantitative research was conducted to assess baseline awareness of the EES and measure and seek feedback on potential impacts • Follow-up research to be conducted at the end of the EES phase to test awareness levels against the baseline.	• Initial research demonstrated: – 69 per cent of the Edithvale respondents had 'some' awareness of the EES – 63 per cent of the Bonbeach respondents had 'some' awareness of the EES.

As a result of the telephone surveys completed at the start of the EES phase, the two issues that stood out as most important for respondents were:

- the impact on traffic flow during and after construction (44 per cent of Edithvale respondents and 39 per cent of Bonbeach respondents named this as most important)
- impacts on the natural environment, including the Edithvale-Seaford Wetlands (Edithvale 41 per cent and Bonbeach 30 per cent).

When asked if there was anything else more important to them that the EES should consider, the issues most raised were:

- **Edithvale:** impact on the natural environment (trees/water table), the impact on local residents during construction, a preference for an underground option, look of the design/aesthetics.
- **Bonbeach:** the look of the design/aesthetics, impact on local residents during construction, preference for an underground option, consideration for pedestrians and children using the area.

A community workshop was held on 14 September 2017 with 32 community members and covered three key themes and topics: walking and cycling connections, the look and feel of the station precinct and planning and managing disruption.

There was concern about the viability of a shared path alongside the rail line although many suggested that travel to the beach was by foot, stressing the importance for improved safety for pedestrians crossing the Nepean Highway. Many expressed an interest in 'beachy' themed stations with natural treatments that blend into the village community. Other comments included the need for hardy and ample plants to survive the beach landscape and a well-lit and open design to improve safety. There were concerns about increased disruption during construction, as well as increased noise levels. While feedback was mixed on the best time to undertake the works, all agreed that strong communication and adequate advance warning was required before any works.

12.5.4 Preliminary design

A round of consultation is scheduled for early 2018 to encourage people to view the information presented in the EES and seek feedback through formal channels.

Planned methods of engagement for this phase include a dedicated website, information sessions and activities to identify and inform hard to reach communities. A broad communications campaign would be carried out to promote the exhibition and would include newsletters letterbox drops to residents, signage, media, advertising, website, email and social media updates.

12.5.5 Project delivery

A comprehensive Community and Stakeholder Management Plan would be developed to support the delivery phase of the projects.

During project delivery, the focus of engagement would shift to information on timing and impacts from the construction activities. This would include considering community concerns and feedback around construction impacts, and how the project team can avoid, minimise or mitigate impacts and disruptions.

These activities would be supported by the establishment of a Stakeholder Liaison Group (SLG) to help facilitate communication during construction. Members would meet bi-monthly to discuss construction progress and raise any issues. Ongoing communications via letters, phone calls, Variable Message Signs, emails, social media and online channels would continue.

12.6 Consultation activities and tools

LXRA has used a range of communications and engagement activities and tools to keep people informed of the process and progress for each project, and to highlight opportunities for involvement along the way. Community and stakeholder feedback is collected, recorded and considered as part of the project at each stage in LXRA's community database, as well as through its online systems and hard copy feedback forms.

Engagement activities have been targeted to the various phases, audiences and needs of each stakeholder. These methods are listed below.

12.6.1 Print communications

Traditional print communications have been used extensively throughout the engagement to disseminate information and seek public participation. These have included:

- project newsletters dropped to neighbouring suburbs and available at local train stations, libraries and council and Member of Parliament offices
- fact sheets, brochures, posters and signage
- media and advertising
- maps and other visual aids.

12.6.2 Digital communications

Dedicated pages were established on the LXRA website <www.levelcrossings.vic.gov.au> and updated regularly with consultation opportunities. An online engagement tool, through the 'Your Level Crossings' online engagement hub has proven a successful way to gain feedback. Other methods included:

- email updates
- social media
- videos, 3D modelling and digital advertising.

12.6.3 Engagement

Engagement methods have been targeted to the audience and phase of the project. A CRG was established during the EES phase to facilitate communication and inform on progress. Workshops were also held on key topics of interest, such as urban design and walking and cycling connections, to capture local perspectives, insights and aspirations for local communities during the design development phase. Additional avenues of engagement included:

- stakeholder briefings to help strengthen relationships, encourage participation and increase understanding of project issues and opportunities
- meetings involving one-on-one discussions with interested traders and residents to hear concerns and address issues
- information sessions during the formal exhibition stage to display EES documentation and provide access to core team members to answer any questions
- community presentations to local groups to increase awareness about the project and EES process.

12.6.4 Hard to reach

During the exhibition phase, a focus of the engagement approach is to ensure all members of the community are able to have their say on the projects. LXRA would implement options to ensure all feedback is captured, particularly those of hard to reach communities. Information for Culturally and Linguistically Diverse (CALD) communities will be provided and a language line for interpreters is already established. Other means would include:

- advertising in specific language publications
- holding events in accessible venues
- consultation with community group leaders to identify vulnerable and hard to reach communities
- collaboration with local government to use known contacts.

12.7 Stakeholders

LXRA has engaged with a range of stakeholders as part of the consultation process – from the early investigations phase through to the EES process. The interest and awareness levels of the communities, particularly those who live or work, in or near Edithvale and Bonbeach has been extremely high, and participation in the projects has been actively encouraged.

Key stakeholders engaged by the project include those that live or work, in or near Edithvale or Bonbeach and/or have an interest in transport, land or environmental impacts.

12.7.1 Approvers and Government

The Victorian Minister for Planning and the Commonwealth Minister for the Environment are the Ministers responsible for the primary project-wide planning and environment approvals for both projects, under the *Planning and Environment Act 1987* and the *Environment Protection and Biodiversity Conservation Act 1999,* respectively. Aboriginal Victoria is also responsible for approving the necessary Cultural Heritage Management Plans.

The project's planning process also requires detailed engagement and a rigorous approval process with regulators and other government agencies including the Commonwealth Department of the Environment and Energy, DELWP, Melbourne Water, EPA Victoria, Heritage Victoria, and the Kingston City Council. Local Members of Parliament were also consulted.

Kingston City Council has had a strong level of engagement in planning for the level crossing removals at Edithvale and Bonbeach. Council was primarily engaged directly via meetings, briefings, attendance at information sessions and representation on the TRG.

12.7.2 Community and stakeholders

Many industry associations, peak bodies, local community groups and transport focused organisations have an interest in the projects. Varied communication methods were used to engage these stakeholders including briefings, information sessions, workshops, presentations and an online presence.

These groups included transport user groups such as the RACV, transport operators being Metro Trains Melbourne, special interest groups like the local surf lifesaving clubs or the Friends of Edithvale-Seaford Wetlands, and the relevant utility providers.

The CRG, established during the EES phase, includes a diverse range of community members including residents, traders, Kingston City Council staff, Bonbeach Life Saving Club, Chelsea Bonbeach Train Station Group, Kingston Conservation and Environment Coalition, and Friends of Edithvale-Seaford Wetlands.

12.8 Feedback received through engagement

LXRA has captured community and stakeholder feedback at each engagement phase. This has allowed communities and stakeholders multiple opportunities to provide input to improve outcomes and share concerns about the design, impacts and benefits of the project from inception to completion.

Continuous improvement has been informed by the feedback received, including tailoring engagement to the community needs, establishing reference groups and informing the detailed designs.

Table 12.6 outlines how feedback has been used to inform design solutions and how it will continue to inform the project.

Table 12.6 How feedback is informing design

Project stage	Timing	How feedback is informing the project
Early planning and consultation for removing the level crossings	February 2016 – October 2016	• Community and stakeholder feedback considered as part of the options analysis and shortlisting phase.
Feedback analysis, further technical works and determination of design solutions – rail trenches	October 2016 – March 2017	• Trenches selected for Edithvale and Bonbeach following community feedback, technical assessments and environmental considerations.
Detailed planning through the EES process	June 2017 – December 2017	• Consultation on detailed aspects of the projects including potential environmental impacts and mitigations, urban design (including streetscape and landscape design), location and design of pedestrian bridges over the trenches, parking, walking and cycling connections, station design and construction impacts • LXRA will provide feedback gained from this phase of the project into its tender process so the contractor is fully briefed and aware of community concerns and desires.
Formal exhibition, Inquiry and Assessment	Early – mid 2018	• Public submissions through the formal exhibition of the EES • Submissions to independent Inquiry and Advisory Committee • Minister for Planning's Assessment and consideration of approvals.
Construction	2019	• Ongoing communication regarding construction, expected impacts and mitigations • Opportunities to inform construction methodology and ways to reduce impacts • Dedicated communications and stakeholder resources to handle issues or concerns during construction.

12.9 Response to feedback

Capturing community and stakeholder feedback has been a vital part of the EES process. Although engagement on the project was initiated some 12 months prior to the EES process commencing, this phase allowed for a more in-depth conversation around targeted topics of interest.

The EES document responds to the impacts and effects of the projects, with the environmental performance requirements capturing responses to these issues. Table 12.7 further outlines the key topics of community and stakeholder interest during the EES phase of the projects and LXRA's responses. This data was captured through face-to-face meetings, online surveys, a community workshop, telephone surveys, the CRG and via written submissions received from Edithvale and Bonbeach residents that came about during the Mentone level crossing removal's planning process, which extended along each side of the rail corridor as far down as Bonbeach.

Table 12.7 LXRA response to community feedback

Project stage timing	How feedback is informing the project
Community members expressed concern about construction impacts, particularly around traffic disruption during construction and associated impacts to local businesses. Noise and interruption to services such as power and internet were also raised as concerns.	• LXRA has removed 10 level crossings over the past two years, with a further 16 currently under construction. Many of these projects have been, and are being undertaken in busy town centres featuring shopping centres and major access routes. LXRA has continually learnt from each project to develop strategies for minimising impacts on the community. • LXRA and its contractors have implemented specific measures on past projects to reduce construction impacts on surrounding communities. Such measures have included: – relocating residents during unavoidable night works or long rail shut down periods – water carts to reduce dust – a dedicated 24-hour community contact line so concerns can be responded to immediately. The successful contractor for these projects would develop targeted strategies outlining how impacts would be managed and communicated to locals before works start. LXRA would review and approve these documents in line with its Contractor Communications Specifications. This includes minimum notice periods for construction works, as well as disruptions affecting commuters, drivers, pedestrians and cyclists. • LXRA has a strong focus on trader engagement. Targeted trader engagement strategies would be developed for the Edithvale and Bonbeach level crossing removal projects. These strategies would include measures to reduce impacts on traders, such as scheduling works outside of busy periods, where possible, as well as developing a 'Shop Local' campaign to promote and highlight local businesses. There are also opportunities to partner with local businesses such as food suppliers to provide services and goods to the workforce and to disrupted commuters during rail shut down periods. The trader engagement strategies would be developed by the preferred contractor for the projects, with input and oversight from LXRA.
There was interest in the location and type of access that would be provided across the rail trench. Previous phases of engagement had indicated approximate locations of pedestrian overpasses. Some alternatives were provided during this phase for community comment. Pedestrian safety is a concern for locals.	• LXRA have focused heavily on consulting with the community on movement and access, and the proposed locations of pedestrian rail crossings. • During a survey conducted for Edithvale during the design phase, LXRA sought feedback on replacing the pedestrian crossings at Berry Avenue and Denmark Avenue with elevated pedestrian crossings. Ground level access could also be available at Fraser Avenue. • 76 per cent of those who responded to the Edithvale survey indicated that they were either satisfied or very satisfied with the proposed locations of the pedestrian rail crossings. • The same survey was done for Bonbeach, where LXRA are proposing to combine the Broadway/Wellwood and Golden/Chadwell pedestrian level crossings into one, safer elevated crossing to be located at Golden Avenue and Chadwell Grove. The Broadway/Wellwood pedestrian level crossing will be removed. • 55 per cent of those who responded were either satisfied or very satisfied with the location of the Bonbeach pedestrian rail crossing.

Project stage timing	How feedback is informing the project
CRG members and stakeholder groups such as the Friends of the Edithvale-Seaford Wetlands expressed concern about the possible environmental effects of the project, particularly any effects on regional groundwater and the internationally protected wetlands.	• LXRA has undertaken significant investigations into the possible environmental effects of the project, particularly any effects to the ecology of the Edithvale-Seaford Wetlands and regional groundwater. • The technical work and findings have been peer reviewed by some of the country's foremost experts in this field. In addition, feedback was sought from the project's TRG and associated agencies during the process. • Following this work, it was determined there would be a negligible impact on the wetlands as a result of the project. • The EES findings and recommendations would be considered by the Victorian Minister for Planning and the Commonwealth Minister for Environment and Energy. • LXRA would comply with the recommendations resulting from these stringent and transparent legislative processes.
The look and feel of the new station precincts attracted some interest. There were many suggestions for particular design treatments, such as matching in with the natural beach environment. Many commented that stations should be designed as open and welcoming buildings that discourage undesirable behaviour such as vandalism and crime.	• LXRA has a strong focus on urban design, having developed overarching principles and project-specific guidelines for Edithvale and Bonbeach. These have been informed by community feedback. • Chapter 11 *Urban design approach* provides further detail regarding the design opportunities and constraints for these sites. • LXRA and its contractor would continue to provide opportunities for community and stakeholder input as the projects progress towards construction. • Although there are limited opportunities for planting and landscaping with the rail trench solutions, LXRA would continue to work with local groups on environmental initiatives associated with the project, such as station plantings and water-sensitive design treatments.
Many expressed concern about the lack of car parking in both Edithvale and Bonbeach. There was concern about lack of parking during construction, as well as in the ultimate design.	• LXRA, through its traffic studies, is looking at potential offsite parking locations for a large workforce during construction. While some parking would be affected by construction activities, this would be minimised as much as possible to keep parking available to locals. • The trench solution does not offer opportunities to increase parking compared with the current offering. LXRA is ensuring no net loss of commuter parking as part of its design and would continue to look for opportunities to optimise parking where possible.
A number of community members reinforced their preference for rail trenches. There was some concern regarding the EES process and whether the findings could trigger a change in design to a rail bridge.	• The Victorian Government announced rail trench solutions for Edithvale and Bonbeach in February 2017. This EES process has assessed the potential environmental effects of the construction and operation of rail trenches. • The project designs have been amended to mitigate potential effects on groundwater, and LXRA maintains that trench solutions are feasible at both Edithvale and Bonbeach. • The EES and its findings will now be referred to the Victorian Minister for Planning for his assessment.

12.10 Ongoing engagement

LXRA is committed to continuing to inform, consult and involve community members and stakeholders during the next phase of the level crossing removals at Edithvale and Bonbeach.

The following communications and engagement activities are planned to help inform the public on the final documentation and encourage participation during formal exhibition:

- community information sessions
- focus on hard to reach communities
- respond to email and phone queries
- communications regarding the exhibition including:
  - newsletters letterbox drops to residents
  - signage
  - media and advertising
  - website information and email updates
  - social media
  - pop-ups.

Upon completion of the EES process during mid to late 2018, planning and environmental approvals are expected to be obtained. This would lead to further design development in preparation for construction to commence, all of which would be outlined in a comprehensive communications and engagement strategy that would be developed to support the delivery phase of the projects.

During this phase, the key priorities are to inform the community of construction timing and associated impacts prior to works commencing, while obtaining feedback to encourage continuous improvement.

LXRA would undertake the following communications and engagement activities during this time:

- ongoing communications via newsletter and email updates, website information and social media
- respond to email and phone queries
- establish a Stakeholder Liaison Group (SLG) to help facilitate communication during construction. Members would meet bi-monthly to discuss construction progress and raise issues or concerns.

In addition, the successful project delivery partner would be required to develop a Construction Environmental Management Plan to ensure that processes and controls are put in place to avoid, minimise or mitigate potential environmental effects.

ATTACHMENT I: LEGISLATION AND POLICY REPORT

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Abbreviations

Term	Definition
AAQ	Ambient Air Quality
AQM	Air Quality Management
ASC	Assessment of Site Contamination
CASS	Coastal Acid Sulfate Soil
CHL	Commonwealth Heritage List
CHMP	Cultural Heritage Management Plan
CM Act	*Coastal Management Act 1995*
DELWP	Department of Land, Water and Planning
EE Act	*Environment Effects Act 1978*
EES	Environment Effects Statement
EP Act	*Environment Protection Act 1970*
EPA Victoria	Environment Protection Authority Victoria
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESO	Environmental Significance Overlay
GoV	Groundwaters of Victoria
HO	Heritage Overlay
IWRG	Industrial Waste Resource Guidelines
LPPF	Local Planning Policy Framework
LXRA	Level Crossing Removal Authority
MSS	Municipal Strategic Statement
MTPFA	*Major Transport Projects Facilitation Act 2009*
NEPC	National Environmental Protection Council
NEPM	National Environment Protection Measures
NHL	National Heritage List
P&E Act	*Planning and Environment Act 1987*
PEM	Protocol for Environmental Management
PMCL	Prevention and Management of Contamination of Land

Term	Definition
PRINP	Passenger Rail Infrastructure Noise Policy
SBO	Special Building Overlay
SEPP	State Environment Protection Policy
SPPF	State Planning Policy Framework
VAHR	Victorian Aboriginal Heritage Register
VHI	Victorian Heritage Inventory
VHR	Victorian Heritage Register

Purpose

Section 3.6 of the Scoping Requirements (released in September 2017) requires the EES to 'identify relevant legislation, policies, guidelines and standards, and assess their specific requirements or implications for the project'.

The approvals likely to be required for the Edithvale and Bonbeach level crossing removal projects (the projects) include:

- approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
- an amendment to the Kingston Planning Scheme under the *Planning and Environment Act 1987*
- an approved cultural heritage management plan under the *Aboriginal Heritage Act 2006*
- permits to take protected flora and/or fauna from public land under the *Flora and Fauna Guarantee Act 1988*
- permits to take wildlife under the *Wildlife Act 1975*
- consent to use and develop coastal Crown land or land within 200 metres of the high-tide mark under the *Coastal Management Act 1995*.

In addition to these, the projects have been declared under the *Major Transport Projects Facilitation Act 2009*.

This report summarises each of the environmental aspects assessed in the EES, presented in a series of tables. Each table describes the legislation, policies, guidelines and standards relevant to the projects, and assesses specific requirements or implications for the projects. Additional legislation, policies, guidelines and standards may apply to specific components or environmental impacts or effects of the projects and the grant of the relevant approvals, particularly in respect of highly technical matters. Where applicable, these are discussed further in the relevant technical report attached to the EES, which should be read in conjunction with these tables.

Where relevant, each table is separated into:

- international standards
- Commonwealth legislation, policies, guidelines and standards
- State legislation, policies, guidelines and standards and local policies

Instruments of legislation, policies, guidelines and standards are addressed under the relevant state or Commonwealth sections of the tables.

Environmental impact assessment

Document	Description	Implications for the projects
Commonwealth		
Legislation		
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation. It provides for the conservation of biodiversity and the protection of the environment, particularly those aspects which are considered to be among the nine Matters of National Environmental Significance (MNES), including World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally-listed threatened species and ecological communities and listed migratory species. The Act states that 'controlled' actions, i.e. actions that are determined as likely to have a significant impact on a MNES are subject to assessment and approval under the Act.	LXRA (as the project proponent) referred the projects to the Commonwealth Environment Minister (referral number 2017/2906). On 8 May 2017, the delegate for the Commonwealth Minister for the Environment determined that the projects are a 'controlled action' and that further assessment and approval is required under the EPBC Act before the projects can proceed. This decision was made having regard to the potential for the projects to impact the Ramsar-listed Edithvale-Seaford Wetlands and the associated listed flora and fauna.
State		
Legislation		
Environment Effects Act 1978 (EE Act)	The Act contains a framework by which projects with the potential to have significant effects on the environment may require the preparation of an Environment Effects Statement (EES) for assessment by the Minister for Planning. An EES may be required for declared 'public works' or works determined by the minister to require an EES following referral. Where an EES is required, scoping requirements are issued by the Minister for Planning to guide the preparation of the EES. Once prepared it is placed on exhibition for public review and submission (typically for a period of 30 days). Public submissions can be considered in a number of ways by an inquiry panel appointed by the minister who may also be required to conduct a formal hearing. After considering all relevant submissions and conducting any necessary hearings, the inquiry panel's report is provided to the Minister for Planning to assess the environmental effects of the project to relevant statutory decision-makers to inform their decision whether or not to approve the project and, if so, on what conditions.	In September 2017, the minister issued finalised Scoping Requirements for the projects. LXRA is preparing the EES for the projects in accordance with the Scoping Requirements which require the assessment of a range of specific environmental effects including in respect of the following subject matters in this table: groundwater, ecology and acid sulfate soils and contamination. The EES will be placed on public exhibition for a period of 30 business days, and an inquiry panel will be appointed to consider the environmental effects of the projects. At the conclusion of the EES assessment process the Minister for Planning's Assessment Report will be provided to the statutory decision makers to inform their decision whether to grant approvals for the projects.

Document	Description	Implications for the projects
Planning and Environment Act 1987 (P&E Act)	This Act establishes a framework for planning the use development and protection of land in Victoria. It provides for the preparation of planning schemes in each municipality consistent with the Victoria Planning Provisions and procedures by which planning schemes may be amended and planning permits obtained to govern land use and development. Where a draft planning scheme for a project is exhibited with an EES it is not uncommon for the Minister for Planning to make the relevant planning scheme amendment at the conclusion of the EES assessment process under section 20(4) of the Act without further notice or exhibition of the amendment.	A planning scheme amendment for each of the projects would seek to insert an Incorporated Document into the planning scheme. The Incorporated Documents are co-exhibited with this EES. Refer to EES Attachment IV *Planning Scheme Amendment*.
Major Transport Projects Facilitation Act 2009 (MTPF Act)	The purpose of the *Major Transport Project Facilitation Act 2009* is to facilitate the development of major transport projects in Victoria. It contains a range of facilitating provisions including in relation to land acquisition and assembly including in respect of private, public, council and Crown land and dealing with utilities.	The projects were separately declared as major transport projects to which the delivery provisions of the Act apply by the Victorian Premier on 21 September 2017; the Minster for Public Transport was appointed as the project minister for each project on 21 September 2017; and the Secretary to the Department of Economic Development, Jobs, Transport and Resources was appointed as the project proponent for each project on 11 October 2017.
Policy / guidelines / standards		
Ministerial guidelines for assessment of environmental effects under the Environment Effects Act 1978	The Ministerial Guidelines are made under section 10 of the EE Act, and supplement the requirements of the EE Act by providing further detail about the EES Assessment process.	The EES Scoping Requirements for the projects were issued in September 2017 consistent with the Ministerial Guidelines pursuant to which the EES is being prepared.

Groundwater

Document	Description	Implications for the projects
Commonwealth		
Legislation		
National Environment Protection Council Act 1994 (NEPC Act)	This Act allows the National Environmental Protection Council (NEPC) to issue National Environment Protection Measures (NEPMs). These measures are framework documents containing national environmental protection objectives. They assist in protecting or managing particular aspects of the environment.	See ASC NEPM below.
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	As discussed in Section 2, the Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation. It provides for the conservation of biodiversity and the protection of the environment, particularly those aspects which are considered to be among the nine Matters of National Environmental Significance (MNES), including World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally listed threatened species and ecological communities and listed migratory species. The Act states that 'controlled' actions, i.e. actions that are determined as likely to have a significant impact on a MNES subject to assessment and approval under the Act.	The EES Scoping Requirements specifically require that the EES examine the potential effects on other beneficial uses of groundwater due to alterations in the groundwater regime, along with risks to human health, recreation and ecosystems due to changes in water quality from activation and excavation of acid sulphate soils and from interception/movement of existing contaminated soil and groundwater.
Policy / guidelines / standards		
National Water Quality Management Strategy 1994	This strategy is a joint national approach to improving water quality in Australian and New Zealand waterways developed by the Australian and New Zealand Governments in cooperation with state and territory governments. It aims to 'achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development'. The strategy includes 21 subsidiary guideline documents with a focus on many aspects of water quality including groundwater quality.	These principles have guided the project's scientific investigations, groundwater impact assessment and strategies to minimise impacts on groundwater. The Strategy implements a number of State Environment Protection Policies for water quality that must be adhered to during the delivery of the projects.

Document	Description	Implications for the projects
National Environment Protection (Assessment of Site Contamination) Measure (NEPC 2013) (ASC NEMP)	The ASC NEPM provides general guidance in relation to investigation levels for soil, soil gas and groundwater in the assessment of site contamination to ensure effective management by the community and to provide adequate protection of human health and the environment where known contamination has occurred. The ASC NEPM is divided into two schedules: • Schedule A identifies the recommended process for the assessment of site contamination • Schedule B identifies 10 general guidelines for the assessment of site contamination.	The assessment of groundwater affected by the projects includes evaluation of potential contaminated groundwater using the guidance recommended by ASC NEPM.
State		
Legislation		
Environment Protection Act 1970 (EP Act)	This Act is the primary legislation regulating the protection of Victoria's environment including protecting water environments from pollution. The Act establishes the Environment Protection Authority (EPA) to administer the Act and regulations and Orders made under the EP Act including Orders declaring State Environment Protection Policies (SEPPs) including the State Environment Policy (Groundwaters of Victoria) discussed below.	The projects are subject to the requirements of the *State Environment Protection Policy (Groundwaters of Victoria)* in relation to groundwater management and disposal.
Water Act 1989	This Act is the primary legislation for the integrated management of Victoria's water resources. The Act promotes efficient use and allocation of water resources, and provides a formal means for protecting and enhancing waterway flow, water quality and catchment conditions. It applies to the management of groundwater, and imposes licensing requirements in relation to the dewatering of groundwater. The Act establishes the Department of Environment, Land, Water and Planning (DELWP) as the authority responsible for the sustainable, efficient, equitable management and allocation of groundwater. For groundwater in southern Victoria, the DELWP has delegated this responsibility to Southern Rural Water, whose responsibilities include licensing any extraction from and injection to the groundwater system. Groundwater dewatering and recharge through bores requires a licence from Southern Rural Water (for construction of bores and for pumping to/from bores).	LXRA may require the following approvals for the projects under this Act: • a licence to construct groundwater monitoring bores (from Southern Rural Water) • a licence to extract groundwater for construction purposes (from Southern Rural Water) If groundwater recharge bores are required, an approval from the Minister for Environment under section 76 of the Act.

Document	Description	Implications for the projects
Climate Change Act 2017	The *Climate Change Act 2017* establishes a long-term emission reduction target of net zero by 2050. The Act embeds the 2050 net zero emissions target and provides for the setting of 5-yearly interim greenhouse gas emissions reduction targets, climate change strategies, and adaptation action plans to ensure the 2050 target is achieved and vulnerabilities to climate change impacts are reduced while potential opportunities are realised. Adaptation action plans will cover systems including the built environment and transport.	The model for the groundwater impact assessment uses the *DELWP Guidelines for Assessing the impact of Climate Change on Water Supplies in Victoria* to ensure that the outputs of the model take into account predicted effects of climate change on groundwater resources. The model was calibrated to climate data from the last 20 years (commencing in January 1997) covering a period of extreme climatic conditions including the Millennium Drought and conditions of above average rainfall from 2010 to 2011. The same climate data was used for forward predictions to assess the impact of the projects under a range of climatic conditions including an 800 millimetre increase in sea level, estimated by increasing the coastal and other tidal boundary heads and a reduction in recharge to unconfined aquifers by 52.8% as per the high climate change impact scenario for the catchment by year 2065.
Policy / guidelines / standards		
State Environment Protection Policy (Groundwaters of Victoria) (SEPP (GoV))	SEPPs are subordinate instruments to the *Environment Protection Act 1970* and set out policies to establish environmental quality objectives, SEPP GoV sets a statutory framework for groundwater protection and the clean-up and management of polluted groundwater. The policy defines the beneficial uses to be protected according to discrete segments of the groundwater environment (bands of total dissolved solids (TDS) concentrations). SEPP Groundwater refers to the SEPP (WoV) where assessing impact of groundwater that might discharge to surface water environments. The SEPP (WoV) includes objectives for the protection of surface water beneficial uses and the maintenance of ecosystems, which includes the point of discharge/interaction of groundwater and surface water.	Compliance with the SEPP (GoV) is required, which is given effect under the *Environmental Protection Act 1970*. The projects would seek to minimise the potential for adverse impacts on groundwater quality to ensure that existing beneficial uses are protected.

Document	Description	Implications for the projects
SEPP Waters of Victoria 2003 (SEPP (WoV))	SEPPs are subordinate instruments to the *Environment Protection Act 1970* and set out policies to establish environmental quality objectives. SEPP (WoV) provides the legal framework for the protection and rehabilitation of Victoria's surface waters to protect beneficial uses. It guides and supports the establishment of regional catchment and coastal planning processes, in which the community identifies the regional environmental, social and economic values of surface waters, and after careful consideration of their environmental, social and economic values and needs, sets appropriate goals, priorities and targets. It contains numerous schedules that address special environmental protection measures needed for sensitive segments of the environment. Where a Schedule exists, both SEPP (WoV) and the Schedule may apply, but if specific beneficial uses and objectives are outlined in the Schedule, these have precedence over those in the SEPP (WoV).	Compliance with the SEPP (WoV) and its associated policy impact assessment (PIA) is required, which is given effect under the EP Act. Relevant provisions of this SEPP will need to be considered in the evaluation of the projects, including the environmental water quality standards required to protect beneficial uses.
SEPP Prevention and Management of Contamination of Land 2002 (PMCL)	SEPPs are subordinate instruments to the *Environment Protection Act 1970*, and set out policies to establish environmental quality objectives. SEPP (PMCL) establishes beneficial use of land in Victoria and provides a mechanism for determining whether these uses are being protected, such as indicators and objectives for use in assessing impacts. Contamination concentrations are set for protection of beneficial uses (maintenance of ecosystems, human health, buildings and structures, aesthetics, production of food, flora and fibre). The SEPP (PMCL) applies to both historically contaminated land and current activities.	Compliance with the SEPP (PMCL) is required, which is given effect under the EP Act. The SEPP Land provides specific reference to beneficial use criteria for potential contaminants which, if exceeded, may indicate that beneficial uses are precluded as well as methodologies for assessing impacts, which will be used for the assessment of the projects' impacts in relation to contaminated land.

Ecology

Document	Description	Implications for the projects
Commonwealth		
Legislation		
Environment and Biodiversity Protection Act 1999	As discussed in Section 2 of this table, the Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation. It provides for the conservation of biodiversity and the protection of the environment, particularly those aspects which are considered to be among the nine Matters of National Environmental Significance (MNES), including World Heritage Properties, National Heritage Places, Ramsar wetlands, nationally listed threatened species and ecological communities and listed migratory species. The Act states that 'controlled' actions, i.e. actions that are determined as likely to have a significant impact on a MNES subject to assessment and approval under the Act.	The projects are a controlled action requiring assessment and approval under the Act. The projects will be assessed under the bilateral agreement.
State		
Legislation		
Planning and Environment Act 1987 (P&E Act)	As discussed in Section 2, this Act establishes a framework for planning the use, development and protection of land in Victoria. It provides for the preparation of planning schemes based on the Victoria Planning Provisions and procedures by which planning schemes may be amended and planning permits obtained to govern land use and development. Planning provisions apply to the removal of native vegetation, which may require planning approval from the responsible authority.	Some native vegetation will need to be removed as part of the delivery of the projects. This will need to be identified assessed and offset (as required) in accordance with the DELWP Permitted clearing of native vegetation – Biodiversity Assessment Guidelines (except as otherwise permitted by the Secretary under the planning scheme amendment for the projects).

Document	Description	Implications for the projects
Flora and Fauna Guarantee Act 1988 (FFG Act)	This Act is the primary legislation dealing with biodiversity conservation and sustainable use of native ecology in Victoria. It provides a legal framework to enable and promote conservation of Victoria's native flora and fauna, and to enable management of potentially threatening processes. Threatened species and communities of flora and fauna, as well as threatening processes, are listed under this Act. Section 47 provides that a permit is required for the removal of any listed protected flora from public land.	The projects must consider impacts to flora and fauna and a formal ecological assessment is occurring as part of the EES process which will identify any ecological assets affected. A permit will be required to remove listed flora from public land.
Wildlife Act 1975	This Act includes procedures to protect and conserve wildlife and to protect species from extinction. It prohibits and regulates the conduct of persons engaged in activities concerning or relating to wildlife. All fauna species indigenous to Victoria are listed as protected under this Act.	Any potential for impact to these species will require authorisation from DELWP.
Catchment and Land Protection Act 1994 (CaLP Act)	This Act is the principal legislation relating to the management of pest plants and animals in Victoria and establishes a framework for the management and protection of catchments through the management of land and water resources. Under the Act, landowners have a responsibility to avoid causing or contributing to land degradation, including taking all reasonable steps to conserve soil, protect water resources, eradicate regionally prohibited weeds, prevent the growth and spread of regionally controlled weeds and, where possible, eradicate established pest animals declared under the Act. The Act categorises weeds and their respective management requirements into: • State prohibited weeds • Regionally prohibited weeds • Regionally controlled weeds • Restricted weeds.	Any potential for the spreading of noxious weeds will need to be avoided or appropriately managed. CaLP Act listed weed species present within the projects' alignment require that the proponent take all reasonable steps to prevent the growth and spread of regionally controlled weeds.

Document	Description	Implications for the projects
Policy / guidelines / standards		
Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines (Department of Environment and Primary Industries 2013)	These Guidelines have been designed to manage the risk to Victoria's biodiversity associated with the removal of native vegetation, and are relevant to: • the permit application process • site assessment and methodology • specific permit conditions such as offsetting. The guidelines are an Incorporated Document in the Kingston Planning Scheme.	Some native vegetation will need to be removed as part of the delivery of the projects. This will need to be identified, assessed and offset (as required) in accordance with the Permitted clearing of native vegetation – Biodiversity Assessment Guidelines (except as otherwise permitted by the Secretary under the planning scheme amendment for the Projects).
DEWLP Victorian Advisory Lists	The DELWP Victorian Advisory Lists are non-statutory lists of species for which conservation management is recommended. The presence, or likely presence, of a species listed on the Advisory List is used to determine whether species-specific habitat is required to be offset.	The project areas will need to be assessed for potential habitats of species listed on the Advisory List.
State Planning Policy Framework (SPPF)	SPPF is common to all Victorian planning schemes, and contains policies in relation to various themes including Clause 12 in relation to Environmental and Landscape Values. This has a series of specific provisions, including those for: • Biodiversity – Protection and conservation of Victoria's biodiversity, including important habitat for Victoria's flora and fauna and other strategically valuable biodiversity sites • Native vegetation management – prevents loss of biodiversity as a result of clearance of native vegetation.	Consideration of the SPPF is relevant to the evaluation of the projects, and the planning scheme amendment which is required for the projects.

Document	Description	Implications for the projects
State Planning Policy Framework (SPPF) – Planning Scheme Provisions and Controls	The Kingston planning scheme contains planning controls, provisions and requirements for planning approval under various zones, overlays and particular provisions which (without the planning scheme amendment) would apply to the projects. The Environmental Significance Overlay (ESO) is one such provision in relation to ecological matters which identifies areas where the development of land may be affected by environmental constraints and ensures that development is compatible with identified environmental values. Particular provisions including Clause 52.17 in relation to the removal of native vegetation are also relevant.	The application of Clause 52.17 and the ESO will need to be considered in the evaluation of the projects.
Local Planning Policy Framework (LPPF)	The Kingston planning scheme contains the LPPF setting out the municipal strategic statement and local planning policies that apply to the planning schemes, in addition to the SPPF. Key clauses specific to landscape and visual are: • Clause 21.08 (Foreshore) seeks to protect the integrity of the coastal asset for its social, ecological and environmental values underpinned in City of Kingston's, the community and relevant government departments' common management objectives. • Clause 21.09 (Environment, Wetlands and Waterways) addresses issues of potential impact and protection of biodiversity and environmental values including in and around wetlands and waterways and provides guidance (from an environment and landscape perspective) in terms of new development • Clause 21.11 (Open Space) seeks to provide fair and equitable access to high quality open space and to promote a diverse range of social and recreational opportunities.	The LPPF within each of the relevant planning schemes will need to be considered in the evaluation of the projects, including those provisions relevant to ecological issues.

Acid Sulfate Soils and Contamination

Document	Description	Implications for the projects
Commonwealth		
Legislation		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	As discussed in Section 2, this Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation.	The projects are a controlled action requiring assessment and approval under the Act. The projects will be assessed under the bilateral agreement.
National Environment Protection Council Act 1994 (NEPC Act)	This Act allows the National Environmental Protection Council (NEPC) to issue National Environment Protection Measures (NEPMs). These measures are framework documents containing national environmental protection objectives. They assist in protecting or managing particular aspects of the environment.	See ASC NEPM below.
Policy, Guidelines, Standards		
National Environment Protection (Assessment of Site Contamination) Measure (NEPC 2013) (ASC NEPM)	This provides a national approach to the assessment of potentially contaminated sites to ensure effective management by the community and to provide adequate protection of human health and the environment where known contamination has occurred. See Section 7 for further discussion. The NEPM is referenced under the State Environment Protection Policy (Prevention and Management of Contamination of Land) (see below).	In Victoria, the ASC NEPM is mainly implemented through the State policies and guidelines described below. The NEPM and associated State policies and guidelines are used as the basis for the assessment of contaminated land potentially disturbed by the projects.
Australian Standard AS4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil – non-volatile and semi-volatile compounds **Australian Standard AS4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil – volatile substances**	AS4482.1-2005 provides guidance for the collection of sufficient and reliable information for the assessment of a site potentially contaminated by non-volatile and semi-volatile compounds. It includes the formulation of data quality objectives and design of a sampling plan to meet the objectives of the investigation. AS4482.2-1999 sets out guidance for collecting sufficient and reliable information for the assessment of a potentially contaminated site.	These standards provide guidance when sampling and investigating potentially contaminated soils (for non-volatile, semi-volatile and volatile compounds).

Document	Description	Implications for the projects
State		
Legislation		
Environment Protection Act 1970 (EP Act)	As discussed in Section 3, the EP Act is the primary legislation regulating the protection of Victoria's environment from pollution and the management of waste. The Act establishes the Environment Protection Authority (EPA) to administer the Act and regulations and Orders made under the EP Act including Orders declaring State Environment Protection Policies (SEPPs). The EP Act protects and manages the impacts to or disposal of contaminated or acid sulfate soils via the implementation of the State Environment Protection Policy (Prevention and Management of Contaminated Land).	Any excavated material that may be potentially contaminated or are acid sulfate soils must be removed, disposed of or reused in accordance with the SEPP (Prevention and Management of Contaminated Land) (see below).
Planning and Environment Act 1987 (P&E Act)	This Act establishes a framework for planning the use, development and protection of land in Victoria. It provides for the preparation of planning schemes in each municipality consistent with the Victoria Planning Provisions and procedures by which planning schemes may be amended and planning permits obtained to govern land use and development.	Section 12(2) (a) of the PE Act requires that in preparing a planning scheme amendment, a planning authority must have regard to the Minister's Directions, including Direction 1 Potentially Contaminated Land. The projects will need to incorporate measures ensuring that contamination is appropriately managed, and that the environmental condition of the Land is suitable for the future intended use.
Catchment and Land Protection Act (CALP) 1994	As discussed in Section 4, the Act establishes a framework for management and protection of catchments through the management of land and water resources. The Act is the principle legislation relating to the management of pest plants and animals in Victoria. Under the Act, landowners have a responsibility to avoid causing or contributing to land degradation, including taking all reasonable steps to conserve soil, protect water resources, eradicate regionally prohibited weeds, prevent the growth and spread of regionally controlled weeds and where possible, eradicate established pest animals as declared under the Act.	The projects will need to ensure that land degradation is avoided and that steps are taken to conserve soil and protect water resources.

Document	Description	Implications for the projects
Environment Protection (Industrial Waste Resource) Regulations 2009	These regulations: - include a definition of prescribed waste and prescribed industrial waste - sets rules for transporting prescribed industrial waste - include provision for exemptions based on beneficial re-use.	Any prescribed waste generated by the projects must be subject to these regulations.
Policy / guidelines / standards		
State environmental protection policy (SEPP), Prevention and Management of Contamination of Land	SEPPs are subordinate instruments made under the EP Act and set out policies to establish environmental quality objectives. SEPP (Prevention and Management of Contamination of Land) establishes beneficial uses of land in Victoria. It provides a mechanism for determining whether these uses are being protected, such as indicators and objectives for use in assessing impacts. Contamination concentrations are set for protection of beneficial uses (maintenance of ecosystems, human health buildings and structures, aesthetics, production of food, flora and fibre). The SEPP applies to both historically contaminated land and current activities.	The beneficial use criteria for potential contaminants and methodologies for assessing impacts are applicable to the assessment of the projects.
Industrial Waste Resource Guidelines (IWRGs) - **EPA Victoria (2009c) Publication IWRG 621: Industrial Waste Resource Guidelines – Soil Hazard Categorisation and Management** - **EPA Victoria (2009d) Publication IWRG 702: Soil Sampling** - **EPA Victoria (2010) Publication IWRG 600.2: Waste Categorisation** **EPA Victoria Classification of Wastes (Publication 448, May 2007)**	The IWRGs have been developed by EPA Victoria to provide guidance for the management of waste, including waste soil, in Victoria. The guidelines explain how to determine the waste category of excavated material based on site history and testing for contaminants to determine a hazard category and reasonably expected to be present and defining the categories of 'fill material' and 'prescribed industrial waste'. The 2007 Publication provides guidance on EPA requirements for the classification of waste and the suitable re-use, management or offsite disposal of each category of waste.	These guidance documents will be used in the categorisation of waste generated by the projects. In particular, IWRGs will provide guidance on the sampling and categorisation of excavated waste soils to be moved off site for reuse or disposal.

Document	Description	Implications for the projects
Industrial Waste Management Policy (Waste Acid Sulfate Soils) Special Gazette S125 published on 18 August 1999	The Industrial Waste Management were introduced into the EP Act by the *Environment Protection (Industrial Waste) Act 1985* to improve the management of industrial wastes. This policy aims to protect human health and the environment from acid sulfate soils by providing a management framework and specific requirements for the management of acid sulfate soils in an environmentally responsible manner.	Excavation of potential acid sulfate soils required by the projects will be assessed and managed for acid sulfates according to this policy and the relevant guidelines.
Victorian Best Practice Guidelines for Assessing and Managing Coastal Acid Sulfate Soil	The Guidelines provide a guide for landowners, developers and decision makers through a staged risk identification approach that assists to make decisions about the assessment and management of Coastal Acid Sulphate Soils (CASS) to help protect the environment, humans and infrastructure from the adverse impacts associated with CASS disturbance.	The guidelines will be used to manage acid sulfate soils associated with the excavation occurring during the construction period, and their disposal.
Environmental Guidelines for Major Construction Sites – Publication 480 (EPA Victoria, 1996).	The Guidelines provide a framework within which due diligence obligations can be met and environmental damage can be avoided during the commissioning or construction of major developments.	Management and disposal of contaminated or acid sulfate soils for the projects will be undertaken in accordance with these guidelines.

Surface Water

Document	Description	Implications for the projects
Commonwealth		
Legislation		
***Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)**	As discussed in Section 2, this Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation.	The projects are a controlled action requiring assessment and approval under the Act. The projects will be assessed under the bilateral agreement.
Policy / guidelines / standards		
National Water Quality Management Strategy 1994 (NWQMS)	The policy sets the water quality objectives required to sustain current environmental values for natural or semi-natural water resources in Australia and New Zealand. The document identifies limits to acceptable change in water quality that would continue to protect the associated environmental value. It aims to 'achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development'. The NWQMS includes 21 subsidiary guideline documents covering ambient and drinking water quality, monitoring, groundwater, rural land uses and water quality, stormwater, sewerage systems and effluent management for specific industries.	These principles have guided the projects' scientific investigations, surface water impact assessment and strategies to minimise impacts on surface water. The Strategy implements a number of State Environment Protection Policies for water quality that must be adhered to during the delivery of the projects.
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC 2000)	The policy sets the water quality objectives required to sustain current environmental values for natural or semi-natural water resources in Australia and New Zealand. The document identifies limits to acceptable change in water quality that would continue to protect the associated environmental values.	Meeting the guidelines will provide a level of certainty that there would be no significant impact on waterways or beneficial users.
Australian Guidelines for Water Quality Monitoring and Reporting 2000	These Guidelines provide a comprehensive framework and guidance for the monitoring and reporting of fresh and marine waters and groundwater.	These guidelines will be reflected in the water quality monitoring programs within the projects' environmental performance requirements.

Document	Description	Implications for the projects
The Framework for Marine and Estuarine Water Quality Protection 2002	This framework is issued under the NWQMS. The Framework aims to protect the nation's marine environment from the adverse effects from sediment, nutrients, pathogens, heavy metals and other pollutants due to land-based activities such as urban, industrial and agricultural development. This Framework provides a nationally consistent approach to coastal water quality protection including development of Water Quality Improvement Plans (WQIP) for key coastal waterways threatened by pollution.	WQIP for in coastal waterways will be considered in the assessment of the impact of the projects' water quality impacts.
Australian Rainfall and Runoff Guideline Document (Engineers Australia, 1987 and revisions) (ARR)	This ARR is a national guideline for estimating design flood characteristics in Australia, providing guidance on appropriate techniques and methods for determining design flood flows and levels.	Any hydrologic or hydraulic investigation required to assess the projects' impacts, is required to adopt the standards identified in this guideline.
Australian Runoff Quality: A Guide to Water Sensitive Urban Design (Engineers Australia, 2006)	This guideline is an overview of current best practice in the management of stormwater in Australia. It provides information on structural Water Sensitive Urban Design (WSUD) features, as well as stormwater contaminant processes and pollutant characteristics, harvesting and re-use, and targets to protect receiving waters.	This guideline influences the methods adopted for water quality impact assessment of the Projects.
State		
Legislation		
Water Act 1989	As discussed in Section 3, the Act is the primary legislation for the integrated management of Victoria's water resources. It promotes fair and efficient use and distribution of water resources and to ensure water resources are appropriately conserved and properly managed for sustainable use. The Act also governs the entitlement of water authorities. Melbourne Water is the authority responsible for managing Melbourne's waterways and major drainage systems. The powers given to Melbourne Water under this Act are primarily implemented through By-Law No. 2: Waterways, Land and Works Protection and Management (see below). Approval is required from Melbourne Water for any works on, over or under a designated waterway or within a flood overlay such as a Special Building Overlay (SBO).	Consent will be required to undertake works in the SBO prior to commencing construction.

Document	Description	Implications for the projects
Environment Protection Act 1970 (EP Act)	As discussed in Section 3, the Act is the primary legislation regulating the protection of Victoria's environment from pollution and the management of waste. The Act establishes the Environment Protection Authority (EPA) to administer the Act and regulations and Orders made under the EP Act including Orders declaring State Environment Protection Policies (SEPPs). The EP Act protects and manages the impacts to surface water flow and quality via the implementation of the State Environment Protection Policy (Waters of Victoria).	Any discharge into a waterway or groundwater during the construction of the project must be in accordance with the requirements of SEPP (Waters of Victoria) (see below).
Planning and Environment Act 1987 (P&E Act)	As discussed in Section 2, the Act regulates the use and development of land in Victoria. The Act sets out the structure and administration of planning in Victoria and authorises the preparation, approval and adoption of planning schemes and planning scheme amendments by planning authorities. The Victorian Planning Provisions provide a legislative framework for the management of surface water by the implementation of planning overlays, particularly the Special Building Overlay (SBO) and the Land Subject to Inundation Overlay (LSIO). The SBO identifies land in urban areas liable to inundation by overland flows from the urban drainage system and ensures that development maintains the free passage and temporary storage of floodwaters, and minimises flooding hazards. The LSIO identifies land in a flood storage area affected by the 1 in 100 year flood events. It also ensures that development maintains the free passage and temporary storage of floodwaters, and minimizes flooding hazards.	The controls associated with the flood-related overlays require approval from Melbourne Water for any works on, over or under a designated waterway or within a SBO and LSIO.
Climate Change Act 2017	The *Climate Change Act 2017* establishes a long-term emission reduction target of net zero by 2050. The Act embeds the 2050 net zero emissions target and provides for the setting of 5-yearly interim greenhouse gas emissions reduction targets, climate change strategies, and adaptation action plans to ensure the 2050 target is achieved and vulnerabilities to climate change impacts are reduced while potential opportunities are realised. Adaptation action plans will cover systems including the built environment and transport.	The projects' surface water impact assessment considers sea level rise, increases in greenhouse gas emissions leading to an increase in the frequency and intensity of extreme weather events and a 19% increase in rainfall intensity predicted by the Australian Rainfall & Runoff.

Document	Description	Implications for the projects
Catchment and Land Protection (CALP) Act 1994	This Act is the principal legislation relating to the management of pest plants and animals in Victoria. This is discussed further in Section 4.	The projects have the potential to promote the spread of noxious weeds.
Coastal Management Act 1995	This Act enables co-ordinated strategic planning and management for the Victorian coast, management plans for coastal Crown land, and a co-ordinated approach to approvals for the use and development of coastal Crown land. The Act provides for long-term strategic planning and management through the Victorian Coastal Strategy (see below). One of the objectives of the Act is to 'maintain and improve coastal water quality'. Section 37 of this Act requires written consent of the minister to use or develop coastal Crown land.	Consent will be required to use and develop coastal Crown land under this Act. In particular, consent to undertake works within 200 metres of the high-tide mark.
Policy / guidelines / standards		
Victorian Waterway Management Strategy (2013)	The strategy provides the policy direction for managing Victoria's waterways over an eight year period. It involves the development and implementation of regional waterway strategies for 10 catchment management regions across Victoria.	Compliance with the strategy will ensure that the condition of rivers, estuaries and wetlands are improved or maintained to provide environmental, social, cultural and economic value for Victorians.
Healthy Waterways Strategy (2013)	The strategy describes Melbourne Water's role in managing rivers, estuaries and wetlands in Port Phillip Bay and Westernport to improve waterway health.	The projects should not inhibit Melbourne Water's ability to achieve this strategy.

Document	Description	Implications for the projects
State Environment Protection Policy (Waters of Victoria) (2003)	SEPPs are subordinate instruments to the EP Act, and set out policies to establish environmental quality objectives. SEPP (WoV) provides the legal framework for the protection and rehabilitation of Victoria's surface waters It provides for: • Beneficial uses and values of Victoria's fresh and marine water environments • Objectives and indicators for the environmental quality required to protect them • Guidance to authorities for protection and rehabilitation of waterways in order to meet objectives • Measures to be implemented to control the environmental impact of discharges and protect the beneficial uses of water. SEPP (WoV) includes schedules with beneficial uses, environmental quality indicators and objectives for specific watercourses within the d ifferent catchments.	Water discharged to waterways must comply with the quality requirements specified in the Policy.

Land Use and Planning

Document	Description	Implications for the Projects
Commonwealth		
Legislation		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	As discussed in Section 2, this Act is the Commonwealth's principal environmental protection and biodiversity conservation legislation.	The projects are a controlled action requiring assessment and approval under the Act. The projects will be assessed under the bilateral agreement.
State		
Legislation		
Environment Effects Act 1978 (EE Act)	As discussed in Section 2, this Act contains a framework by which projects with the potential to have significant effects on the environment may require the preparation of an EES for assessment by the Minister for Planning. At the conclusion of the assessment process, the minister's assessment report is provided to statutory decision-makers to inform their decision on whether or not to grant an approval for the project and, if so, on what conditions. The minister's assessment determines whether the likely environmental effects of a project are acceptable, and whether any modifications or specific mitigation measures are required to achieve acceptable outcomes. Decision-makers are required to consider the minister's assessment and are encouraged to consult with the minister where it is not proposed to adopt the assessment.	An EES is required for the projects, and the minister's assessment will be provided to relevant decision-makers to inform their decision on whether or not to approve the projects and if so on what conditions. This includes the decision to prepare, adopt and approve a planning scheme amendment for the project under the P&E Act.

Document	Description	Implications for the Projects
Planning and Environment Act 1987 (P&E Act)	As discussed in Section 2, the Act establishes a framework for planning the use development and protection of land in Victoria. It provides for the preparation of planning schemes in each municipality consistent with the Victoria Planning Provisions and procedures by which planning schemes may be amended and planning permits obtained to govern land use and development. The Act imposes obligations on a planning authority responsible for the preparation of an amendment including the following: • The requirement to comply with relevant directions or guidelines issued by the Minister for Planning including the form and content of any planning scheme. For relevant directions or guidelines see discussion under the Policy, Guidelines and Standards below. • The requirement to implement the objectives of planning in Victoria, provide sound, strategic and co-ordinated planning of the use and development of land and prepare an explanatory report in respect of any proposed amendment to a planning scheme. The objectives of planning in Victoria are contained in section 4(1) of the Act and are set out in full below: a. To provide for the fair, orderly, economic and sustainable use, and development of land b. To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity c. To secure a pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria d. To conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value e. To protect public utilities and other assets and enable the orderly provision and co-ordination of public utilities and other facilities for the benefit of the community f. To facilitate development in accordance with the objectives set out in paragraphs (a), (b), (c), (d) and (e) g. To balance the present and future interests of all Victorians.	The projects are subject to the requirements of the Kingston Planning Scheme. Under the controls of the Kingston Planning Scheme planning permits are required for buildings and works and the removal of native vegetation associated with the projects. Planning scheme amendments are being prepared pursuant to Section 20(4) of the P&E Act for the projects which would exempt the projects from the requirements to obtain planning permits subject to specific conditions. A draft planning scheme amendment has been prepared for each of the projects and will be co-exhibited with the EES. A copy of the draft planning scheme amendment can be seen in Attachment V *Draft Planning Scheme Amendment*.

Document	Description	Implications for the Projects
(continued) Planning and Environment Act 1987 (P&E Act)	h. In preparing a planning scheme amendment a planning authority: – Must have regard to the minister's directions – Must have regard to the Victoria Planning Provisions – In the case of an amendment, must have regard to any municipal strategic statement, strategic plan, policy statement, code or guideline which forms part of the scheme – Must take into account any significant effects which it considers the scheme or amendment might have on the environment or which it considers the environment might have on any use or development envisaged in the scheme or amendment – Must take into account its social effects and economic effects – In respect of an amendment that the Minister for Planning prepares, the minister may exempt himself from the requirements of sections 17, 18 and 19 of the Act and the regulations (in relation to notice and exhibition) "if the Minister considers that compliance with any of those requirements is not warranted or that the interests of Victoria or any part of Victoria make such an exemption appropriate".	
Coastal Management Act 1995 (CM Act)	The Act is established to plan for and manage the use of Victoria's coastal resources on a sustainable basis for a wide range of appropriate uses and to protect and maintain areas of environmental significance on the coast. The act also aims to facilitate development of a range of facilities for improved recreation and tourism, to maintain and improve coastal water quality and to improve public awareness and involvement in coastal planning and management.	Consent to use and develop coastal Crown land or land within 200 metres of the high-tide mark is required under this Act.
Major Transport Projects Facilitation Act 2009 (MTPF Act)	The purpose of this Act is to facilitate the development of major transport projects declared under the Act. It contains a range of facilitating provisions including in relation to: • Land acquisition and assembly including in respect of public, private, council and Crown land • Road construction, deviation, closure and management • Dealing with utilities.	The projects were separately declared by the Victorian Premier on 21 September 2017 granting the projects use of the project delivery provisions for construction.

Document	Description	Implications for the Projects
Transport Integration Act 2010 (TI Act)	The Act provides a legislative framework for transport in Victoria. The Act seeks to integrate land use and transport planning and decision-making by applying the framework to land use agencies whose decisions can significantly impact on transport. The Act requires agencies, including the Department of Transport and Planning Authorities, to consider the potential impact of land use planning proposals on transport. The objectives and principles of this Act include integrated decision making, transparency, the precautionary principle and consideration of the transport system user perspective.	The projects are to be assessed with the triple bottom line framework and should contribute to the efficient and effective movement of people and goods and minimise disruption. The transport system objectives have been considered in the development of the projects.
Crown Land (Reserves) Act 1978 ***Land Act 1958***	This Act provides for the reservation of land for a range of public purposes, stipulates how reserved land must be dealt with and prescribes key governance arrangements for committees of management appointed to manage reserved land.	The provisions of Part 6 of the MTPF Act enable Crown land reserved under the Crown Land (Reserves) Act 1978 to be used for the purposes of a declared project. These provisions are likely to be utilised to facilitate development of the projects, to the extent that any reserved Crown land will be impacted by the projects.
Land Acquisition and Compensation Act 1986	This Act sets out the process for the compulsory acquisition of interests in land and the payment of compensation. An acquiring authority must comply with the processes set out under the Act where these powers are relied upon, except to the extent modified by the MTPF Act for any declared project under that Act.	The project authority for the projects will be obliged to comply with the provisions of the Act as modified by the MTPF Act, to the extent that any interest in land needs to be compulsorily acquired for the projects. The provisions of the Act (as modified) may also apply to the extent that any access or temporary occupation of land is required for development of the projects.
Aboriginal Heritage Act 2006	The Act primarily to provide for the protection of Aboriginal cultural heritage in Victoria. Section 49 of this Act states that a Cultural Heritage Management Plan (CHMP) is required to be prepared when an EES under the EE Act is required in respect of any works. This plan must be prepared prior to the commencement of works.	An EES for the projects has been undertaken, LXRA will prepare mandatory CHMPs for works to commence as required by section 49 of the *Aboriginal Heritage Act 2006.*

Document	Description	Implications for the Projects
Heritage Act 2017	This Act creates a system to protect and conserve places and objects of cultural heritage significance in Victoria. The Act establishes: - The Victorian Heritage Register (VHR) lists heritage places (buildings, streets, precincts properties etc) and heritage objects (moveable items such as signs, wrecks artefacts) within a defined extent, generally stating why they are significant. The VHR is aimed at preserving listed items and any subdivisions or physical works to a listed item will require a Heritage permit unless there is an exemption or only works with no adverse heritage impact are proposed. The Victorian Heritage Inventory (VHI) lists known historical (non-Aboriginal) archaeological sites of unknown or less than state significance. There is currently no significance threshold for VHI places and recording, excavating and monitoring are the usual methods of assessing and managing the heritage values of a site. Section 129 of the Act provides that any activities that would result in the excavation of or disturbance to an archaeological site or its objects included on the VHI must first obtain the consent of Heritage Victoria.	The impact assessment determined that the project areas do not include or immediately adjoin any heritage sites or places identified on the Victorian Heritage Register or Victorian Heritage Inventory. Permits or consents are not required from Heritage Victoria under the Act. No approvals are required under the Act.
Flora and Fauna Guarantee Act 1988	This Act is the primary legislation dealing with biodiversity conservation and sustainable use of native ecology in Victoria. It provides a legal framework to enable and promote conservation of Victoria's native flora and fauna, and to enable management of potentially threatening processes. Threatened species and communities of flora and fauna, as well as threatening processes, are listed under this Act. Section 47 provides that a permit is required for the removal of any listed protected flora from public land.	The projects must consider impacts to flora and fauna and a formal ecological assessment is occurring as part of the EES process which will identify any ecological assets affected. A permit will be required to remove listed flora from public land.

Document	Description	Implications for the Projects
Policy / guidelines / standards		
Kingston Planning Scheme	The planning scheme contains planning controls, provisions and requirements for planning approval under various zones, overlays and particular provisions which (without the planning scheme amendment) would apply to the projects. The planning scheme contains the SPPF which seeks to ensure that the objectives of planning in Victoria as set out in the P&E Act are fostered through appropriate land use and development policies and practices integrating relevant environmental, social and economic factors in the interests of net community benefit and sustainable use and development. The SPPF contains polices in relation to the following themes, with many policies referring to additional policies, guidelines or reference material which are to be considered as relevant: • Settlement • Environmental and landscape values • Environmental risks • Natural resource management • Built environment and heritage • Housing • Economic development • Transport • Infrastructure. A planning authority is required to consider these policies when preparing a planning scheme amendment, and balance competing objectives in favour of net community benefit and sustainable development for the benefit of present and future generations. The planning scheme also contains LPPF that are to be taken into account when preparing a planning scheme amendment.	The provisions of the planning scheme will need to be considered in the evaluation of the projects and in preparation of the planning scheme amendment for the projects.

Document	Description	Implications for the Projects
Plan Melbourne, 2017–2050	Plan Melbourne 2017-2050 is the Victorian Government's long range strategic plan for metropolitan Melbourne, setting out directions, initiatives and actions for land use, transport and infrastructure. It is referenced in the SPPF.	Plan Melbourne 2017–2050 is relevant to the evaluation of the Projects and the planning scheme amendment required for the Projects. In particular, the amendment delivers on Outcome 3: Melbourne has an integrated transport system that connects people to jobs and services and goods to market by specifically delivering on: Policy 3.1.1: Create a metro-style rail system with 'turn up and go' frequency and reliability, which includes the delivery of separated road and rail crossings, Policy 3.1.2: Provide high-quality public transport access to job-rich areas by enhancing access to activity centres along the Frankston rail corridor, the Dandenong NEIC, locally and regionally important employment nodes, and to wider metropolitan Melbourne, and Policy 3.1.3 Improve arterial road connections across Melbourne for all road users by removal of level crossings.

Traffic

Document	Description	Implications for the projects
Commonwealth		
Legislation		
There is no specific Commonwealth legislation applicable to traffic and transport as approval and regulation of transportation is mainly a function of State legislation.		
State		
Legislation		
Road Management Act 2004 **(RM Act)**	This Act provides a statutory framework for the management of Victorian road networks and the coordination of road reserves for roadways, pathways, infrastructure and similar purposes. While the Minister for Roads and Road Safety is responsible for administering the Act, VicRoads is responsible for the management of roads within a Road Zone, Category 1 (which includes Nepean Highway), while local councils are responsible for all other roads (Kingston City Council for the projects).	The declaration of the projects under the MTPF Act affords the projects access to the road management provisions within Division 8 of Part 6 of the MTPF Act. These would be utilised for the delivery of the projects in lieu of the requirements of the RM Act.
Transport Integration Act 2010 **(TI Act)**	As discussed in Section 7, the Act provides a legislative framework for transport in Victoria. The Act seeks to integrate land use and transport planning and decision-making by applying the framework to land use agencies whose decisions can significantly impact on transport. The Act requires agencies, including the Department of Transport and Planning Authorities, to consider the potential impact of land use planning proposals on transport. The objectives and principles of this Act include integrated decision making, transparency, the precautionary principle and consideration of the transport system user perspective.	The transport system objectives are considered in the development of the projects and in the preparation of the planning scheme amendment for the projects.

Document	Description	Implications for the projects
Policy / guidelines / standards		
Cycling and Walking Plan 2009-2013 (City of Kingston	The Kingston Cycling and Walking Plan 2009 – 2013 provides a snapshot of the current status of the Kingston cycling and walking facility network and raises opportunities for further enhancement of the network. It also details strategies and actions that council can examine over the coming five years to ensure that the network is progressing in accordance with State and Federal objectives for cycling and walking facilities, as well as local needs and demand.	The level crossing and associated works (such as the provision of a Shared Use Path and grade separated rail crossings) are aligned with the following objectives of the plan: • Objective 1: A quality network of cycling and walking routes which enhance access to local activity hubs • Objective 5: Improved safety for bicycle riders and pedestrians
Community Safety Strategy 2013-2017	The Strategy draws together information about the safety concerns of the community and the actual evidence of crime, injury and hazards affecting Kingston. This information has been used to identify priority areas and objectives for safety issues that have the greatest impact on, or cause the most concern to Kingston residents and visitors.	The level crossing and associated works (such as the provision of a SUP and grade separated rail crossings) are aligned with the following goals and sub-goals of the strategy: • Goal 1: To improve the perceptions of safety during the day and night in Kingston – Activate public spaces with infrastructure to support community activity.
Kingston Road Safety Strategy 2011-2015	A Road Safety Strategy is a strategic document that assists in determining the actions that are likely to have the greatest impact on reducing the number and severity of road crashes. The Strategy will guide the implementation of road safety activities within Kingston over the five-year life of the Strategy.	The level crossing removal and associated works are aligned with the following goals and sub-goals of the strategy: • Objective 4: Reduce the incidence of road trauma in pedestrians within the City of Kingston and the greater community • Objective 6: Reduce the incidents of road trauma in bicyclists and motorcyclists within the City of Kingston and the greater community
VicRoads SmartRoads Framework, 2012	This Framework manages competing interest for limited road space by giving priority use of the road to different transport modes at particular locations and times of the day. It provides operational direction that supports broader strategies around land use and transport.	The Road Use Hierarchy principles within this framework provide guidance during the design phase of the projects.
Road Safety Road Rules, 2017	These Rules provide road rules that are substantially consistent across Australia. They also specify behaviour for all road users.	The projects will facilitate the application of the rules.
Towards Zero 2016-2020 – Victoria's Road Safety Strategy & Action Plan	The strategy references making local and busy places safer, and using roads more safely.	The projects should not inhibit VicRoads' ability to achieve this strategy.

Noise and Vibration

Document	Description	Implications for the projects
International Standards		
British Standard BS 6472-1:2008	This standard provides guidance on vibration levels for different sensitive uses in order to identify where vibration may cause annoyance. For residential uses, compliance with level of perception is typically used where projects should be expected to have no adverse comments, sensations or complaints for the vast majority of persons. Acceptable vibration values are known to be dependent upon social and cultural factors, psychological attitudes and expected interference with privacy. The Standard therefore provides a range of values based upon these expected variations.	This standard has been considered for the projects for the assessment of construction vibration in order to avoid damage to nearby structures. It has been used as a guide to establish human comfort vibration criteria.
German Standard DIN 4150- 3:1999	This standard provides a method for measuring and assessing the effects of vibration on structures. The Standard provides acceptable levels of both short-term and long-term vibration, taking into account any fatigue-related structure failures. The standard is directed towards preventing cosmetic damage such as crack formation in plaster, rather than damage to reinforced concrete structures.	This standard has been considered during the vibration impact assessment for the construction and operation of the projects.
Commonwealth		
Legislation		
There is no specific Commonwealth legislation applicable to noise and vibration.		
State		
Legislation		
Environment Effects Act 1978 (EE Act)	Refer to Table 2.	Refer to Table 2.
Environment Protection Act 1970 (EP Act)	Refer to Table 2.	Refer to Noise Control Guidelines Publication 1254 below.

Document	Description	Implications for the projects
Policy / guidelines / standards		
Noise Control Guidelines, Publication 1254 (EPA Vic, 2008)	While applicable to commercial, industrial and some large-scale residential construction projects, the Noise Control Guidelines provides a basis for determining construction noise targets to reduce noise impacts. The Guidelines are applicable to commercial, industrial and some large-scale residential construction projects. The Noise Control Guidelines provides a basis for determining construction noise targets to reduce noise impacts.	Environmental Performance Requirements proposed for the projects are aligned to the noise targets of EPA Publication 1254.
Passenger Rail Infrastructure Noise Policy (PRINP, Vic, 2013)	The PRINP provides a process that balances the benefits of new passenger rail infrastructure projects with the possible impacts on sensitive receptors. The PRINP sets investigation thresholds for the management of noise impacts for redevelopment of existing rail infrastructure.	As the projects require assessment under the *Environment Effects Act 1978*, they are required to implement the PRINP.
Environmental Guidelines for Major Construction Sites (EPA Publication 480, Vic, 1996)	These guidelines are provided by EPA for developers, contractors and government agencies involved with infrastructure projects to minimise environmental impacts and eliminate health risks and nuisance to residents near construction sites.	Environmental Performance Requirements implemented for the projects are aligned to the noise objectives of EPA Publication 480.
State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No. N-1 (SEPP N-1)	SEPP N-1 aims to protect people from the effects of noise in noise-sensitive areas. The policy is also used as a planning tool and requires new and proposed industries to be designed so as to not exceed the noise limits outlined in the SEPP.	SEPP N-1 applies to the proposed substation for the Edithvale project. The substation is required to operate within the noise limits prescribed in the SEPP.

Air Quality

Document	Description	Implications for the projects
Commonwealth		
Legislation		
National Environment Protection Council Act 1994	The *National Environment Protection Council Act 1994* establishes a framework for the preparation of National Environment Protection Measures (NEPMs). The NEPMs are a set of national objectives designed to assist in protecting or managing particular aspects of the environment. The NEPM for ambient air quality sets national standards for the management of air emissions to the environment. It sets intervention levels, indicating levels of which air emissions would begin to be detrimental to human health on a national level.	The projects consider the NEPM for ambient air quality in conjunction with the State legislation (SEPP AQM and SEPP AAQ), described below.
State		
Legislation		
Environment Protection Act 1970	As discussed in Section 3, the EP Act is the primary legislation regulating the protection of Victoria's environment from pollution and the management of waste. The Act establishes the Environment Protection Authority (EPA) to administer the Act and regulations and Orders made under the EP Act including Orders declaring State Environment Protection Policies (SEPPs). The EP Act protects and manages the air environment via the implementation of the SEPP (Ambient Air Quality) and SEPP AQM (described below).	Projects must comply with design criteria and intervention levels for the assessment of impacts associated with emissions to air.
Planning and Environment Act 1987 (P&E Act)	Refer to Table 2.	Refer to Table 2.

Document	Description	Implications for the projects
Policy / guidelines / standards		
State environment protection policy (Ambient Air Quality) (SEPP AAQ)	SEPP AAQ sets air quality objectives and goals for the State of Victoria. It considers the limits set in NEPM (AQM) (refer to the *National Environment Protection Council Act 1994* above) in the local (state) context. This standard sets goals, monitoring and reporting for six common pollutants.	This policy applies area wide rather than to specific emissions from the projects.
State environment protection policy (Air Quality Management) (SEPP AQM)	SEPP AQM establishes the framework for managing emissions to the air environment in Victoria in order to meet the objectives and goals of SEPP AAQ. SEPP AQM provides design criteria and intervention levels for the assessment of impacts associated with emissions to air. It also sets the Intervention Levels for which monitoring data can be assessed as protecting the beneficial uses of the air environment.	The projects must comply with emissions to the air environment during construction and operation phases against the intervention limits described in SEPP AQM. Where relevant, measures to protect the air environment must be implemented through the EPRs.
Protocol for Environmental Management (PEM): Mining and Extractive Industries (EPA Victoria, 2007)	The Protocol for Environmental Management (PEM): Mining and Extractive Industries is incorporated into SEPP (AQM). The PEM provides guidance in how to assess the potential impacts of emissions arising from mining and extractive industries on the air environment.	For the purposes of this assessment, dust emissions from construction must meet the Mining PEM levels, while operational emissions from ground level line or area sources (such as the existing at-grade rail lines or rail trench) are assessable against the intervention levels detailed in Schedule B of the SEPP AQM. Construction dust expected from the projects can be considered equivalent to a large area source such as that emitted by a mining or extractive industry. The Mining PEM uses the argument that the assessment criteria applicable for the mining and extractive industries are developed based on the protection of human health and for particulate matter the indicators reflect the intervention levels in SEPP AQM. Operational emissions are not required to be assessed against Schedule A of SEPP AQM as the project is not a scheduled premises and in the case of particulate matter are not from a point source.

Document	Description	Implications for the projects
Environmental Guidelines for Major Construction Sites – Publication 480 (EPA Victoria, 1996)	Guidelines are provided by EPA for developers, contractors and government agencies involved with infrastructure projects to minimise environmental impacts, health risks and nuisance to residents near construction sites.	Environmental Performance Requirements implemented for the projects are aligned to the air quality objectives of EPA Publication 480 including dust management and mitigation, and emissions to air from plant.
State Planning Policy Framework (SPPF)	The SPPF within planning schemes provides a framework for integrated policy decision making with regards to how land is used and developed across the state. The framework seeks to ensure that the objectives of planning in Victoria are fostered through appropriate land use and development planning policies and practices which integrate relevant environmental, social and economic factors in the interests of net community benefit and sustainable development. Clause 13.4-2 aims to assist the protection and improvement of air quality by ensuring that land-use planning and transport infrastructure provision contribute to improved air quality.	Consideration of the SPPF is relevant to the evaluation of the Projects, and the planning scheme amendment which is required for the Projects.

Landscape and visual

Document	Description	Implications for the projects
International Standards		
The Guidelines for Landscape and Visual Impact Assessment, Third Edition (2013), (GLVIA) developed by the Landscape Institute and Institute for Environmental Management (United Kingdom).	Contains a methodology for the assessment of landscape and visual effects.	In the absence of an Australian methodology, these guidelines have informed the landscape and visual impact assessment for the projects.
Commonwealth		
Legislation		
There is no specific Commonwealth legislation applicable to landscape and visual.		
Policy / guidelines / standards		
Creating Places for People: An Urban Protocol for Australian Cities (2011)	This protocol aims to promote high quality urban design outcomes across Australia. It is founded on five pillars: productivity, sustainability, liveability, leadership and design excellence. It establishes 12 principles for quality urban places which can be applied to any project.	The Urban Design Guidelines for the projects and LXRA's Urban Design Framework have been based on this protocol.
State		
Legislation		
Environment Effects Act 1978 (EEA)	This Act contains a framework for the assessment of potential environmental impacts or effects of certain developments, enabling statutory decision-makers to decide whether a project with potentially significant environmental effects should proceed.	An EES is required for the projects, and the minister's assessment will be provided to relevant decision-makers to inform their decision on whether or not to approve the projects and if so, on what conditions.
Heritage Act 2017	The main purpose of the Act is to provide for the protection and conservation of places and objects of cultural heritage significance. Heritage significance, in part, includes where a heritage place is situated in relation to its surroundings. Heritage listings under this act often cover wider areas as well as individual buildings.	Visual connectivity to heritage sites is considered in the assessment of landscape and visual impact, and the Urban Design Guidelines. The Urban Design Guidelines (given effect by the EES by way of an EPRs) mandate project alliances to consider the visual impact to heritage sites in relation to their location and line of site from various locations.

Document	Description	Implications for the projects
Policy / guidelines / standards		
Level Crossing Removal Authority Urban Design Framework	LXRA's Urban Design Framework is a project commitment to achieve urban design excellence and maximise positive impacts through collaborative, multi-disciplinary and integrated design thinking. The framework presents an overarching set of principles and objectives, underpinning the role of urban design in the design development.	Urban Design Guidelines have been prepared for each of the projects to guide and inform the Project Alliance during detailed design. The Guidelines reflect the principles and objectives of the framework.
Plan Melbourne	Plan Melbourne 2017-2050 is the Victorian Government's long range strategic plan for metropolitan Melbourne, setting out directions, initiatives and actions for land use, transport and infrastructure. It is referenced in the SPPF.	Plan Melbourne 2017-2050 is relevant to the evaluation of the projects and the planning scheme amendment required for the projects. In particular, Direction 4.5: Plan for Melbourne's green wedges and peri-urban areas: a desired outcome for landscape and open space is to 'protect significant views, maintain non-urban breaks between non-urban areas, and conserve the cultural significance, tourism appeal and character of scenic rural landscapes'.
Local Government		
State Planning Policy Framework (SPPF)	The SPPF is common to all Victorian planning schemes, and encourages the protection and enhancement of the visual environment. Key clauses specific to landscape and visual are: • Clause 12.04-2 Landscapes – Provides guidance to protect landscapes and significant open spaces that contribute to character, identity and sustainable environments. • Clause 15 Built environment and heritage – Planning should achieve high quality urban design and architecture that enhances amenity of the public realm. • Clause 15.01-1 Urban design – Focuses upon the provision of environments that are safe and functional and which reinforce a sense of place and cultural identity. • Clause 15.01-5 Cultural identity/ neighbourhood character – Provides guidance to recognise and protect neighbourhood character and sense of place with specific regard for the built environment and heritage elements.	The SPPF ensures an integrated decision-making process that must take into account the general principles and specific policies within the SPPF. The landscape and visual impact assessment for the projects take into account aesthetic effects on the liveability of neighbourhoods. The projects consider the SPPF and any visual impacts in the draft planning scheme amendment.The SPPF ensures an integrated decision-making process that must take into account the general principles and specific policies within the MSS and LPPF. Each scheme has distinct priorities for landscape and the visual character of neighbourhoods within them and these are delivered through various zones, overlays and other strategies discussed below. The projects consider the SPPF and any visual impacts in the draft planning scheme amendment. Refer to Table 15.

Document	Description	Implications for the projects
(continued) **State Planning Policy Framework (SPPF)**	**Local Planning Policy Framework (LPPF)** The LPPF is specific to each planning scheme. It includes a Municipal Strategic Statement (MSS) and Local Planning Policies used to implement the objectives and strategy of the MSS. Key clauses specific to landscape and visual are: • Clause 21.02 Municipal overview (Environment and heritage) – The environmental landscape of the City of Kingston is recognised for its diversity and significance in both a local and regional context. It includes the Port Phillip Bay and foreshore reserve, other natural and man-made waterways, wetland systems, floodplains, heathlands and significant flora and fauna habitats • Clause 21.04 Vision: (Environment and infrastructure) – To protect and enhance the quality and unique character of Kingston's natural and built environments and infrastructure assets. • Clause 21.05 Residential land use – Protect areas/elements in the built form and natural landscape which have an identified and valued character. • Clause 21.06 Retail and commercial land use – Reinforcing the role the Nepean Highway and Frankston Train Line perform in linking Kingston's principal and major activity centres. • Clause 21.11 Open space – Ensure that new development adjacent to existing public open space is responsive to the natural landscape features of the open space area. • Clause 21.12 Transport, movement and access – To protect and enhance the amenity of Kingston's residential areas and other sensitive land uses through appropriate management of transport networks. **Overlays** The Heritage overlays (as discussed in Table 15) protects significant heritage features, including their appearance and visual context.	

Business

Document	Description	Implications for the projects
Commonwealth		
Legislation		
There is no specific Commonwealth legislation applicable to business.		
State		
Legislation		
Transport Integration Act 2010 (TI Act)	The Act provides a legislative framework for transport in Victoria. The Act seeks to integrate land use and transport planning and decision-making by applying the framework to land use agencies whose decisions can significantly impact on transport. The Act requires agencies, including the Department of Transport and Planning Authorities, to consider the potential impact of land use planning proposals on transport. The objectives and principles of this Act include integrated decision making, transparency, the precautionary principle and consideration of the transport system user perspective. The transport system should facilitate economic prosperity by: • enabling efficient and effective access for persons and goods to places of employment, markets and services • increasing efficiency through reducing costs and improving timeliness • fostering competition by providing access to markets • facilitating investment in Victoria • supporting financial sustainability.	The removal of the Edithvale and Bonbeach level crossings meets all these policy principles, especially enabling the efficient and effective access to businesses.
Planning and Environment Act 1987 (P&E Act)	This Act establishes the framework for planning and managing the use, development and protection of land in Victoria. Its role in project approval and land use planning are discussed in sections 2 and 7. Specific measures for promoting the economy enabled by the Act are discussed below.	See sections 2 and 7.

Document	Description	Implications for the projects
Policy / guidelines / standards		
State Planning Policy Framework (SPPF)	The State Planning Policy Framework (SPPF) is common to all Victorian planning schemes including those which encourage and facilitate sustainable land uses related to business and industrial land uses. See section 3 for further discussion. The key SPPF clauses of relevance to business are: • Clause 11 which states that planning is to respond to the needs of existing and future communities through provision of zones and serviced land for, amongst other things, employment, commercial and community facilities and infrastructure • Clause 17.01-1 which aims to meet the community's needs for retail, entertainment, office and other commercial services and provide net community benefit in relation to accessibility, efficient infrastructure use and the aggregation and sustainability of commercial facilities • Clause 18 which states that planning should ensure an integrated and sustainable transport system that provides access to social and economic opportunities, facilitates economic prosperity, contributes to environmental sustainability, coordinates reliable movements of people and goods, and is safe.	To ensure integrated decision-making, planning authorities and responsible authorities must take into account the general principles and the specific policies contained in the SPPF. The projects are likely to deliver improved access and efficiency associated with transport. However, access to jobs and network efficiency may be temporarily interrupted during construction. The projects will meet the objectives of the SPPF, as demonstrated in the draft planning scheme amendment.
Local Planning Policy Framework (LPPF)	The Municipal Strategic Statement (MSS) provides strategic direction for planning, land use and development within City of Kingston.	The projects will meet the objectives of the LPPF and MSS, as demonstrated in the draft planning scheme amendment.

Social

Document	Description	Implications for the projects
Commonwealth		
Legislation		
Disability Discrimination Act 1992	The Act provides protection for everyone in Australia against discrimination based on disabilities in employment, education, publicly available premises, provision of goods and services, accommodation, clubs and associations and other contexts.	The projects are to be designed to facilitate compliant access during construction and operation phases.
State		
Legislation		
Planning and Environment Act 1987 (P&E Act)	This Act establishes the framework for planning the use, development and protection of land in Victoria. Its role in project approval and land use planning are discussed in sections 2 and 7 respectively. The Act includes the following objectives in relation to improving and maintaining social conditions: • To secure a pleasant, efficient and safe working, living and recreational environment • To protect public utilities and other assets and enable the orderly provision and coordination of public utilities and other facilities for the benefit of the community • To ensure that the effects on the environment are considered and provide for explicit consideration of social and economic effects when decisions are made about the use and development of land.	See Sections 2 and 7.
Transport Integration Act 2010 (TI Act)	As discussed in Section 8, the Act sets out six transport system objectives and eight decision-making principles. The objectives include triple bottom line assessment: economic prosperity, social and economic inclusion and environmental sustainability. Other objectives include: • integration of transport and land use • efficiency, coordination and reliability • safety health and wellbeing.	See Section 8. Planning of the transport system should be integrated with that of land use and facilitate access to social and economic opportunities and that social impacts should be part of the 'triple bottom line' assessment used in decision making.

Document	Description	Implications for the projects
Public Health and Wellbeing Act 2008	The Act aims to promote and protect public health and wellbeing in Victoria by: • protecting public health and preventing disease, illness, injury, disability or premature death • promoting conditions in which persons can be healthy • where appropriate, the state has a role in assisting in responses to public health concerns of national and international significance.	While the Minister for Planning has not specified a health impact assessment be completed for the EES, impacts to public health have been considered through the various impact assessments: • contamination and acid sulfate soils • traffic • noise and vibration • air quality.
Local Government		
State Planning Policy Framework (SPPF)	The SPPF provides a framework for integrated policy decision making with regards to how land is used and developed across the state. The State Planning Policy Framework seeks to ensure that the objectives of planning in Victoria are fostered through appropriate land use and development planning policies and practices which integrate relevant environmental, social and economic factors in the interests of net community benefit and sustainable development.	The projects are to meet the objectives of the SPPF, as demonstrated in the draft planning scheme amendment.
Local Planning Policy Framework (LPPF)	The Municipal Strategic Statement (MSS) provides strategic direction for planning, land use and development within City of Kingston.	The projects are to meet the objectives of the LPPF and MSS, as demonstrated in the draft planning scheme amendment.
Council Plan 2017-2021	The Council Plan features five key goals for the development of Kingston. • Our well-planned, liveable city supported by infrastructure to meet future needs • Our sustainable green environment with accessible open spaces • Our connected, inclusive, healthy and learning community • Our free-moving, safe, prosperous and dynamic city • Our well-governed and r esponsive organisation. The Council Plan also sets responsibilities, and provides responsibilities and a reporting framework to track performance.	The projects have engaged with council and the community during the development of the projects to provide best outcomes.

Aboriginal cultural heritage

Document	Description	Implications for the projects
Commonwealth		
Legislation		
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)	The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined within the Act as matters of national environmental significance. The National Heritage List (NHL), established under the EPBC Act, is a list of natural, historic and Indigenous places of outstanding significance to the nation. National heritage places are protected under the EPBC Act – any action which is likely to have a significant impact on a National heritage place would require approval under the EPBC Act.	The Aboriginal cultural heritage impact assessment found that no registered Aboriginal heritage places of national significance (i.e. matters of national environmental significance listed on the NHL) are within the vicinity of the project areas.
Native Title Act 1993	The Native Title Act 1993 provides a national system for the recognition and protection of native title for Aboriginal and Torres Strait Islanders and for its coexistence with the national land management system.	There are no native title claims relevant to the project area.
State		
Legislation		
Aboriginal Heritage Act 2006 (AH Act)	The Act is primarily to provide for the protection of Aboriginal cultural heritage in Victoria. Section 49 of this Act states that a Cultural Heritage Management Plan (CHMP) is required to be prepared when an EES under the EE Act is required in respect of any works. This plan must be prepared prior to the commencement of works.	An EES for the projects has been undertaken, LXRA will prepare mandatory CHMPs for works to commence as required by section 49 of the *Aboriginal Heritage Act 2006.*
Aboriginal Heritage Regulations 2007	These Regulations set standards and fees for the preparation of a CHMP.	Consideration must be had to these Regulations when preparing the CHMP for the projects.
Policy / guidelines / standards		
Victorian Aboriginal Heritage Register (VAHR)	The Register is established under the *Aboriginal Heritage Act 2006*, and holds the details of all registered Aboriginal cultural heritage places and objects within Victoria.	The impact assessment determined that the project areas do not intersect with any known registered Aboriginal cultural heritage places listed on the VAHR.

Historic heritage

Document	Description	Implications for the projects
Commonwealth		
Legislation		
Environmental Protection and Biodiversity Conservation Act 1999 (EBPC Act)	The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined within the Act as matters of national environmental significance. The National Heritage List (NHL), established under the EPBC Act, is a list of natural, historic and Indigenous places of outstanding significance to the nation. National heritage places are protected under the EPBC Act – any action which is likely to have a significant impact on a National heritage place would require approval under the EPBC Act. The Commonwealth Heritage List (CHL), established under the EPBC Act, is a list of natural, historic and Indigenous places of heritage significance owned or controlled by the Australian Government. Places included on the list have been identified as having heritage values to the Commonwealth and actions which are likely to impact on these values require approval under the EPBC Act.	The historic heritage impact assessment found that no registered historic (post-European settlement) heritage places are of national significance (i.e. matters of national environmental significance listed on the NHL or CHL).
State		
Legislation		
Heritage Act 2017 (Heritage Act)	This Act creates a system to protect and conserve places and objects of cultural heritage significance in Victoria. The Act establishes: • The Victorian Heritage Register (VHR) lists heritage places (buildings, streets, precincts, properties etc) and heritage objects (moveable items such as signs, wrecks, artefacts) within a defined extent, generally stating why they are significant. The VHR is aimed at preserving listed items and any subdivisions or physical works to a listed item will require a Heritage permit unless there is an exemption or only works with no adverse heritage impact are proposed. • The Victorian Heritage Inventory (VHI) lists known historical (non-Aboriginal) archaeological sites of unknown or less than state significance. There is currently no significance threshold for VHI places and recording, excavating and monitoring are the usual methods of assessing and managing the heritage values of a site. Section 129 of the Act provides that any activities that would result in the excavation of or disturbance to an archaeological site or its objects included on the VHI must first obtain the consent of Heritage Victoria.	The impact assessment determined that the project areas do not include or immediately adjoin any heritage sites or places identified on the Victorian Heritage Register or Victorian Heritage Inventory. Permits or consents are not required from Heritage Victoria under the Act. No approvals are required under the Act.

Document	Description	Implications for the projects
Planning and Environment Act 1987 (P&E Act)	The *Planning and Environment Act 1987* (P&E Act) regulates the use and development of land in Victoria. The Act sets out the structure and administration of planning in Victoria and authorizes the preparation, approval and adoption of planning schemes and planning scheme amendments by planning authorities. Under the Victorian Planning Provisions set out within the planning scheme, heritage places are protected under heritage overlays (description below)	The projects are subject to the requirements of the Kingston Planning Scheme. Under the controls of the Kingston Planning Scheme planning permits are required for buildings and works within heritage places, no heritage overlays would be impacted by the projects.
Policy / guidelines / standards		
Kingston Planning Scheme	Places of heritage significance to a local municipality are identified in the Heritage Overlay (HO) of the relevant municipal planning scheme, and can include individual places and broader precinct areas. Statutory heritage controls apply to HO places under the *Planning and Environment Act 1987* and the relevant municipal planning scheme.	There is one HO site included within (HO28) and three HO sites which adjoin the Edithvale project area (HO47, HO48 and HO27). There is one HO site included within (HO31) and three HO sites which adjoin the Bonbeach project area (HO32, HO35 and HO110). Construction works must impact on HO sites included within the project area, and measures must be put in place (through EPRs) to protect them.

JOINT VENTURE

EDITHVALE AND BONBEACH LEVEL CROSSING REMOVAL PROJECTS

ENVIRONMENT EFFECTS STATEMENT

EES Attachment II

Environmental Risk Report

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Release

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0	06/02/2018	**ISSUED FOR USE**	

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Appendices

Appendix A – Consequence table

Appendix B – Risk register

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Appendix D – Risk model inputs

Executive Summary

Risk assessment context

The Victorian Government is removing 50 of Melbourne's most dangerous and congested level crossings, including the level crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach).

This risk assessment report is required as part of the Environment Effects Statement (EES) to assess the potential environmental effects of the projects.

The primary objectives of the risk assessment were to identify risks to the environment posed by the projects, and to assess these risks using a common approach across all specialist disciplines, thereby allowing the risks to be compared and prioritised. The risk assessment identifies areas that require either further impact assessment or additional environmental management in order to avoid, minimise or manage impacts, and thereby informs the management of risk throughout the project design, construction and operation.

This report documents the risk levels posed by the projects after the implementation of management and mitigation measures.

Method

A semi quantitative approach was adopted for the risk assessment. This methodology is consistent with AS/NZS ISO 31000:2009 Risk Management Process in that it is an iterative process which involves risk identification, risk analysis, risk evaluation and risk treatment. The identification, analysis and evaluation of risks were conducted in a series of facilitated workshops. The outputs from the workshops were entered into a risk register and were used as input data to an Excel spreadsheet model to produce a series of risk profiles.

Risks were identified and documented in a risk register, including the phase (construction or design/operation) at which the risk would be likely to occur and the Environmental Performance Requirements necessary to achieve key environmental outcomes.

Key findings

A total of 85 risks to the environment were identified for the construction and operation of both projects. Most of the 85 identified risks apply to both projects, however there are 16 site specific risks for Edithvale, and 13 for Bonbeach.

The table below shows a comparison between the initial risk levels and the residual risk levels for the projects.

The initial risk levels assume that the initial EPRs identified would be in place to mitigate risk. All risks that were minor or above were reviewed by specialists to identify if any EPRs could be updated or added to reduce risks. The residual risk levels assume that the final EPRs would be in place to mitigate risk.

Risk level	Initial risk	Residual risk
Extreme (>1000 risk level)	None	None
Major (>100 risk level)	None	None
Moderate (>10 risk level)	8	4

Risk level	Initial risk	Residual risk
Minor (1-10 risk level)	20	18
Negligible (<1 risk level)	57	63
TOTAL number of risks	85	85

In particular, the introduction of an EPR to specify the environmental outcomes that must be achieved by the projects with respect to groundwater would limit groundwater mounding and drawdown at Edithvale. The addition of these EPRs resulted in the reduction of three of the moderate risks and three of the minor risks to negligible and the reduction of one of the moderate risks to minor.

Four moderate level residual risks were identified, which relate to:

- night-time construction noise
- traffic (delay during main works)
- amenity (construction)
- visual impacts (pedestrian overpasses and substation)

These risks relate to amenity during construction and operation.

18 minor level residual risks were identified which relate to:

- contaminant migration at Edithvale
- threatening processes (habitat fragmentation)
- coastal acid sulfate soil activation at Bonbeach
- native vegetation removal
- night-time construction noise (unplanned works)
- traffic (delay outside main works)
- coastal reserve – native vegetation at Bonbeach
- removal of protected flora
- removal of habitat (non-threatened fauna)
- interference with groundwater users at Bonbeach
- decreased revenue (construction)
- day-time construction noise
- traffic (road safety)
- vibration (amenity)
- lifestyle disruption (cyclists and pedestrians)
- lifestyle disruption (rail and road users)
- visual impacts (construction)
- visual impacts (general)

The remaining 63 identified risks were considered to be negligible.

The moderate and minor residual risks predominantly impact the social and/or environment assets. These risks typically fall into two categories - those risks related to the amenity (or public health and safety) impacts (the four moderate risks and the majority of the minor risks) and those associated with long term groundwater change.

Amenity risks are predominantly associated with construction such as traffic delays, noise and vibration and lifestyle disruption. These risks will peak throughout the rail occupation, during which work is scheduled to occur 24 hours a day for a period of approximately six weeks. There will be some level of impact on the community throughout the 18 month period of construction, but the extent and magnitude of impacts will vary. These risks are typical of all level crossing removals. LXRA has extensive experience in managing environmental performance and community expectations during design and construction. To date, 11 level crossings have been removed and 33 are underway.

The minor groundwater risks are associated with long term changes to groundwater and the impact that this could have on beneficial uses of groundwater.

Abbreviations

Term	Definition
ABS	Australian Bureau of Statistics
ACH	Aboriginal Cultural Heritage (denotes risks associated with Aboriginal cultural heritage)
AQ	Air quality (denotes risks associated with air quality)
ASS	Acid Sulfate Soils
B	Business (denotes risks associated with business)
CASS	Coastal Acid Sulfate Soils
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plan
CL	Contaminated Soil/CASS (denotes risks associated with contaminated soil/CASS)
E	Ecology (within the project areas) (denotes risks associated with ecology (within the project areas))
EES	Environment Effects Statement
EG	Ecology (groundwater dependent ecosystems and wetlands) (denotes risks associated with ecology (groundwater dependent ecosystem and wetlands))
EPA	Environment Protection Authority Victoria
EPR	Environmental Performance Requirement
EWMD	Edithvale Wetland Main Drain
FFG	Flora and Fauna Guarantee Act
GW	Groundwater (denotes risks associated with groundwater)
HH	Historic heritage (denotes risks associated with historic heritage)
HO	Heritage Overlay
JV	AECOM-GHD Joint Venture
LGA	Local Government Authority
LUP	Land use and planning (denotes risks associated with land use and planning)

Term	Definition
LV	Landscape and visual (denotes risks associated with landscape and visual)
LXRA	Level Crossing Removal Authority
NTU	Nephelometric Turbidity Units
NV	Noise and vibration (denotes risks associated with noise and vibration)
PBN	Principle Bicycle Network
PRINP	Passenger Rail Infrastructure Noise Policy
QA	Quaternary Aquifer
S	Social (denotes risks associated with social)
SEPP	State Environment Protection Policy
SW	Surface water (denotes risks associated with surface water)
SWL	Standing water levels
T	Traffic (denotes risks associated with traffic)
TRG	Technical Reference Group
UDG	Urban Design Guidelines
UTAF	Upper Tertiary Aquifer (fluvial)

Glossary

Term	Definition
Consequence	The outcome (or impact) of a specific event
Environment	This includes ecological, cultural, social, heritage, public health and safety and business aspects
Environmental Performance Requirements (EPR)	The environmental outcomes that must be achieved during design, construction and operation of the projects regardless of the design solutions adopted
Final EPR	The EPRs recommended for the project and included in the Environmental Management Framework
Initial EPR	EPRs based on compliance with legislation and standard requirements that are typically incorporated into the delivery of construction contracts for rail projects.
Initial risk	Risk level assessed with initial EPRs in place to manage and mitigate risks
Likelihood	The chance of something happening. It is expressed as a number between 0 and 1, where 0 is impossibility and 1 is an absolute certainty
Planned event	An event which has 100% chance of occurring during the lifetime of the projects
Residual risk	The final risk level assessed with final EPRs in place to manage and mitigate risks
Risk	The condition resulting from the prospect of an event occurring and the magnitude of its consequences
Risk level	Risk level = Likelihood x Consequence
Risk pathway	The cause and effect pathway between a particular project activity and how this could impact on assets, values and uses. In other words, it is a series of potential events (planned or unplanned) that need to occur before an impact is realised
Unplanned event	An event which may or may not occur during the lifetime of the projects

1. Introduction

1.1 Purpose

The Victorian Government is removing 50 of Melbourne's most dangerous and congested level crossings, inclusive of the level crossings at Edithvale Road, Edithvale (Edithvale) and Station Street/Bondi Road, Bonbeach (Bonbeach).

The level crossing removal projects have three core objectives. To provide:

- improved productivity from more reliable and efficient transport networks
- better connected, liveable and thriving communities
- safer communities.

The Edithvale and Bonbeach level crossing removal projects were referred to the Minister for Planning on 9 March 2017. On 5 April 2017, the Minister determined that an Environment Effects Statement (EES) was required for the projects due to the potential for significant environmental effects.

The purpose of this report is to describe the semi-quantitative risk assessment undertaken for the Edithvale and the Bonbeach level crossing removal projects.

1.2 Objectives

The objectives of the risk assessment were to:

- identify risks to the environment posed by the design, construction and operation of the projects, whereby 'environment' includes ecological, cultural, social, heritage, public health and safety and business aspects
- use a common approach to assessing risk across all specialist investigations
- provide a summary of the comparative risks across the projects and understand at which stage of the project the risks are likely to occur
- identify areas that may require either further impact assessment or additional environmental management in order to reduce the extent, magnitude or duration of impacts, thereby reducing risks to the environment.

1.3 Assessment framework

A systematic risk based approach was applied to understand the existing environment, potential impacts of the projects and how to avoid, minimise or manage the risk of impacts to an acceptable level.

As shown in Figure 1, the assessment of risks and impacts and the development of environmental management measures is an iterative process.

An initial risk assessment was undertaken to assess potential risks to the environment arising from the implementation of the projects. The initial risk levels assume that the initial EPRs were in place to manage and mitigate risk. Where risks were minor or above, further mitigation was explored. If further mitigation was identified, EPRs were updated and risks were re-assessed to determine the residual risk. The residual risk levels assume that the final EPRs are in place to manage and mitigate risks.

The risk assessment considered risks to the environment from potential project impacts within the following specialist areas:

- Aboriginal cultural heritage
- historic heritage
- business
- air quality
- noise and vibration
- surface water
- land use and planning
- traffic
- social
- landscape and visual
- ecology (within the project area)
- contamination and spoil management
- groundwater
- ecology (groundwater dependent ecosystems (GDEs) and wetlands).

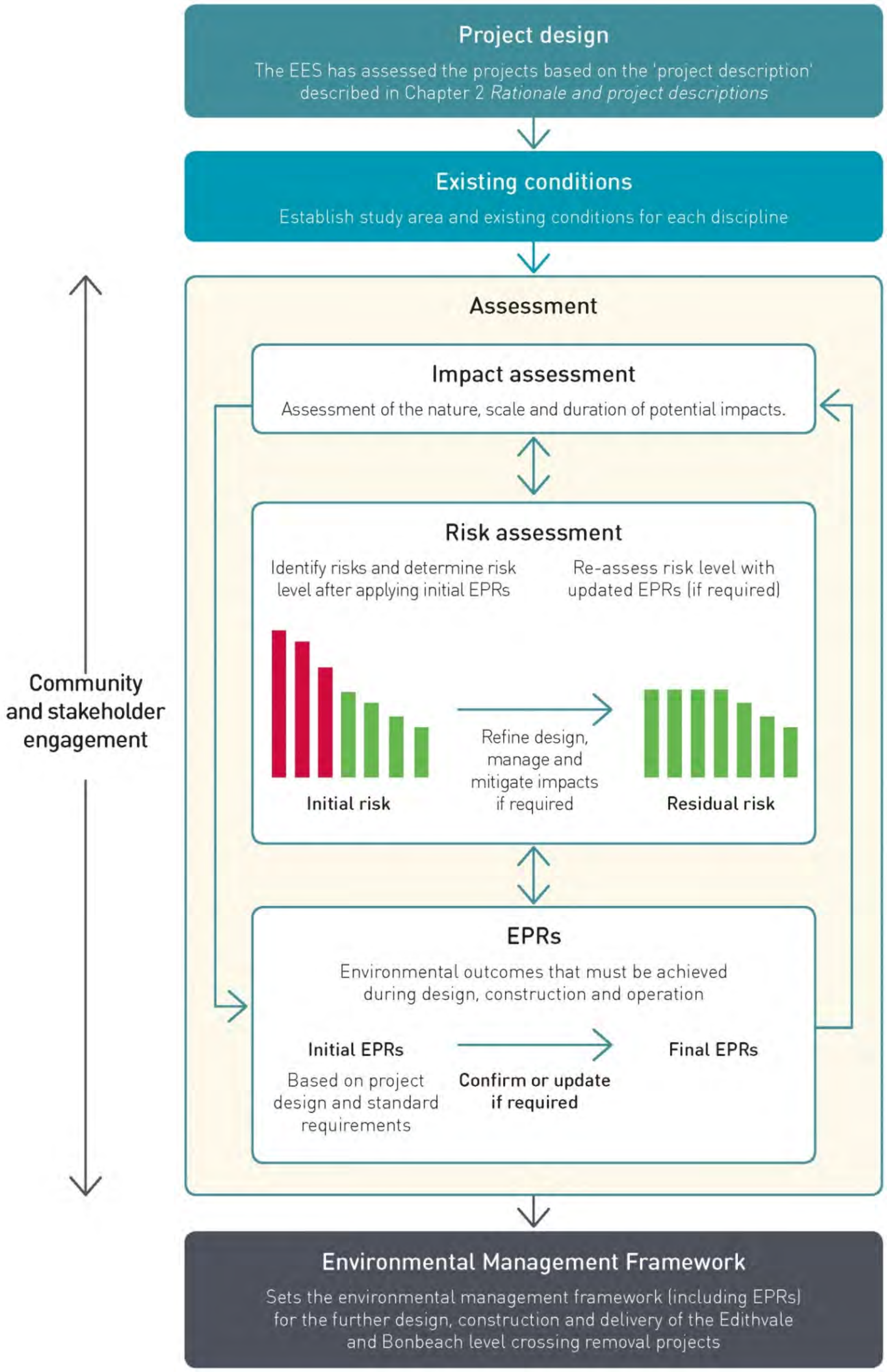

Project design
The EES has assessed the projects based on the 'project description' described in Chapter 2 Rationale and project descriptions
Existing conditions
Establish study area and existing conditions for each discipline
Community and stakeholder engagement
Assessment
Impact assessment
Assessment of the nature, scale and duration of potential impacts.
Risk assessment
Identify risks and determine risk level after applying initial EPRs
Re-assess risk level with updated EPRs (if required)
Initial risk
Refine design, manage and mitigate impacts if required
Residual risk
EPRs
Environmental outcomes that must be achieved during design, construction and operation
Initial EPRs
Based on project design and standard requirements
Confirm or update if required
Final EPRs
Environmental Management Framework
Sets the environmental management framework (including EPRs) for the further design, construction and delivery of the Edithvale and Bonbeach level crossing removal projects

Figure 1 Overview of assessment process

2. Method

2.1 Overview

A semi quantitative approach to risk assessment has been adopted for the Edithvale and Bonbeach Level Crossing Removal EES (Bowden, Lane and Martin, 2001). This approach involves the use of a multi-disciplinary ‘subject matter specialist panel’ for assessing risks to the environment, arising from the implementation of the Edithvale and Bonbeach level crossing removal projects.

This approach was selected because it is able to assess risks associated with social, environmental, public health and safety and economic assets on a relatively even basis. It therefore provides a means to focus effort in terms of impact assessment and mitigation.

The approach to risk assessment is consistent with AS/NZS ISO 31000:2009 Risk Management Process and involves the following steps:

- establishment of the context of the risk assessment
- risk identification
- risk analysis
- risk evaluation
- risk treatment.

The process is designed to be iterative, as shown in Figure 2. The identification, analysis and evaluation of risks were conducted in a series of facilitated workshops.

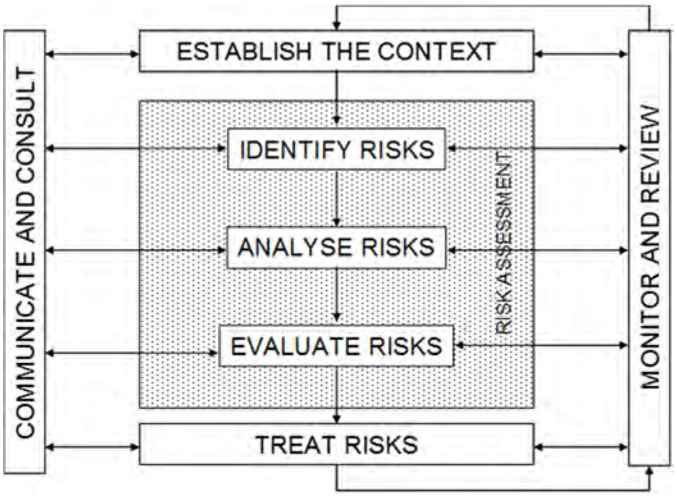


Figure 2 AS/NZS ISO 31000:2009 risk management process

2.2 What is risk

In AS/NZS ISO 31000:2009 Risk Management Principles and Guidelines, risk is defined as ‘the effect of uncertainty on objectives’. In the context of this EES this definition refers to the ability of the Edithvale and Bonbeach projects to achieve their defined evaluation objectives.

More specifically, and more relevant to this report, risk can also be defined as the condition resulting from the prospect of an event occurring and the magnitude of its consequences. Therefore, risk is an intrinsic combination of:

- the likelihood of an event and its associated consequences occurring (this incorporates the likelihood of the event and the likelihood of the consequences occurring each time the event occurs)
- the magnitude of potential consequences of the event.

In quantitative terms, ‘risk’ is defined by a risk ‘level’, which is:

Risk level = Likelihood x Consequence

The risk level is therefore a numerical value that describes the level of risk posed by an event.

The methodology for estimating likelihoods and consequences in this risk assessment is described below.

2.3 Estimating likelihoods and consequences

2.3.1 Planned and unplanned events

A planned event is one that has a likelihood of occurrence of 100 per cent, that is, it is an event that is assumed to occur at least once in the lifetime of either of the projects. An unplanned event is one which may or may not occur during the lifetime of either of the projects i.e. its likelihood is less than 100 per cent.

2.3.2 Risk pathways

A risk pathway is the cause and effect pathway between a particular project activity and how this could impact on assets, values and uses. In other words, it is one or more potential events (planned or unplanned) that need to occur before a consequence or impact is realised. An example risk pathway is described below.

- groundwater drawdown on downgradient side of trench lowers groundwater levels resulting in reduced groundwater availability for registered groundwater users.

In this example the risk pathway is:

- groundwater drawdown on the downgradient side of the trench (cause) → groundwater to be unavailable for registered groundwater users (effect).

2.3.3 Estimating likelihoods

For more common events (i.e. those with a likelihood above around 10 per cent chance of occurrence over the life of either of the projects), the likelihood can usually be estimated to the nearest few percent (e.g. 15 per cent, 20 per cent, 70 per cent) etc.) based on the specifics of the project, a given subject matter expert’s experience or knowledge of similar types of events, and documented information in the industry and literature.

On the other hand, for uncommon activities and events with likelihoods below a 1 per cent chance over the life of the projects, likelihoods are estimated more conceptually and expressed in order of magnitude terms (for example a 1 in 100 or a 1 in 1,000 chance).

To assist in ensuring likelihoods were estimated consistently, a likelihood guide was used. Whilst likelihood estimates reflect specialist judgements, the application of a single guide across the different disciplines ensured greater consistency of these estimates across the Edithvale and Bonbeach risk assessment. The likelihood guide used is shown in Table 1 below.

Table 1 Guide to quantification of likelihood

Qualitative descriptions	Probability over a given time period	Basis
A. Certain	1 (or 0.999, 99.9%)	Certain, or as near to as makes no difference
B. Almost certain	0.2 – 0.9	One or more incidents of a similar nature has occurred here
C. Highly probable	0.1	A previous incident of a similar nature has occurred here
D. Possible	0.01	Could have occurred already without intervention
E. Unlikely	0.001	Recorded recently elsewhere
F. Very unlikely	1×10^{-4}	It has happened elsewhere
G. Highly improbable	1×10^{-5}	Published information exists, but in a slightly different context
H. Almost impossible	$1 \text{ X } 10^{-6}$	No published information on a similar case

Source: Bowden, A.R., Lane, M.R. and Martin, J.H., 2001, *Triple Bottom Line Risk Management – Enhancing Profit, Environmental Performance and Community Benefit,* Wiley and Sons, New York, 314 pp.

Using the groundwater drawdown risk pathway as an example, the likelihood is estimated in a two stage approach.

The likelihood that some groundwater drawdown will occur within a region on the downgradient side of the trench that contains registered groundwater bores is 100%. However, the likelihood of impact on registered groundwater users considers whether the magnitude of this drawdown is likely to actually impact on beneficial users and also the likelihood that registered users are actively using the groundwater. The latter was estimated as being 10%.

These two likelihoods are combined to estimate the total likelihood of occurrence of the risk pathway (100% x 10% = 10%).

2.3.4 Describing consequences

The consequences table used for this risk assessment was based on one initially developed for another major infrastructure project in Victoria in consultation with subject matter specialists. The consequence table has subsequently been adapted and used successfully for other Victorian EESs. It has been tailored to recognise the key issues associated with the Edithvale and Bonbeach projects.

The purpose of the consequences table is to achieve a practical level of consistency when estimating consequence levels across the different technical disciplines (i.e. air, noise, visual, ecology etc.) and four main asset categories (i.e. social, environmental, economic and public health and safety).

The consequence table as provided in Appendix A has specific qualitative consequence descriptions for each of the specialist investigations undertaken. This table was developed with specialist input.

The purpose of the consequences table is to enable diverse and complex consequence types to be evaluated using a normalised (to the extent practicable) scale. Consideration was given to providing descriptions within each consequence level (i.e. negligible, minor, moderate, major, extreme) for each of the following four asset categories (and asset sub-categories) despite the fundamental differences in the nature of the consequences. The terminology and descriptions in the table are meant to provide a guide to assist judgements. In many cases several types of indicators are described in the boxes to help the specialist come to a view on the potential consequence level that could occur. Throughout the consequences table, levels may be described in terms of multiple factors (e.g. magnitude, extent and duration).

For example, the extreme consequence level refers to a high level of impact that could be felt on a State-wide area and which would have permanent or long term negative consequences with little chance of being reversed. In general, a negligible consequence level relates to a level of impact that would be so small that it may not even be noticeable in the context of the existing natural (and other) processes that affect the asset.

These descriptions are not ‘scientific descriptions’ and are intended to be used by application of educated judgement rather than to be rigidly interpreted.

The four asset categories of impact in the consequence table are:

Environment (14 asset sub-categories) – this category is subdivided into the following general environmental sub-asset categories: changes in number of indigenous species, impacts to threatened ecological communities, threatening processes, change in ecosystem function, native vegetation clearance, impacts to Ramsar sites, impacts to GDEs and impacts to air, soil, surface water and groundwater. The descriptions for each level of impact (negligible, minor, moderate, major, extreme) are based on estimates of magnitude of change, the duration and the estimated recovery/re-establishment period following impact.

Social (7 asset sub-categories) – this broadly refers to impacts on individuals and communities – including Aboriginal and non-Aboriginal heritage, loss of amenity through traffic, air, noise, odour or visual impacts, loss of recreational value, direct noise and vibration impacts as well as impacts due to changes in land use and planning. Social consequences seek to balance the level of impact to individuals (and the number of individuals affected) with the overall impact to the community/region. For example a short term (one to two weeks) interruption to a recreation area due to construction might be considered by an affected individual to be a moderate consequence. However from the broader, community perspective, the impact may be negligible.

Economic (1 asset sub-category) – this refers to economic impacts associated with loss of revenue to businesses in dollar terms and general loss of business activity. Business consequences have also been defined from a ‘community’ or ‘regional’ perspective rather than an ‘individual’ perspective. These range from short-term impacts with less than $100,000 loss of revenue to permanent reduction in business activity and loss of revenues of over $1,000,000,000.

Public health and safety (2 asset sub-categories) – the two sub – categories in this category relate to generalised illness, injury or fatalities or specific safety impacts associated with traffic and changes to the road network.

The relative comparability of impacts in the consequences table allows for additive consequences to be assigned under each asset category without unduly overestimating the overall consequence level.

The relative quantitative value adopted for this risk assessment show that each subsequent consequence level represents an order of magnitude increase in the scale of the consequence, which is a critical factor in ensuring that the levels can be applied consistently across all disciplines and which allows for uncertainty in the accuracy of assigning consequences.

2.3.5 The semi quantitative approach

The use of the semi qualitative approach allows the graphical representation of risks in the form of risk profiles and makes their prioritisation easy to visualize. This approach allows risks to be more easily compared against each other.

The outputs of the semi quantitative risk assessment are relative risk rankings and not absolute values. It is not intended that the total risk of the projects be calculated in numerical terms as this would not be a useful or realistic number.

3. Context of the risk assessment

3.1 Introduction

This section provides an overview of the extent of both of the project areas. This section also describes the key design, construction and operational assumptions, including project duration, upon which the risk assessment is based. Finally this section provides a description of the environmental context within which the risk assessment was undertaken.

3.2 Project area

3.2.1 Edithvale project area

The Edithvale Road, Edithvale level crossing project investigation area (Edithvale project area) extends from Lincoln Parade, Aspendale to Chelsea Road, Chelsea. It includes the rail corridor and all of Station Street and Nepean Highway to the east and west of the rail corridor, and small sections of adjacent road reserves. Refer to Figure 3.

3.2.2 Bonbeach project area

The Station Street/Bondi Road, Bonbeach level crossing removal project area (Bonbeach project area) extends from Chelsea Road, Chelsea to Patterson River, Bonbeach. It includes the rail corridor and all of Station Street and Nepean Highway located to the east and west of the rail corridor, and small sections of adjacent road reserves. Refer to Figure 4.

3.2.3 Temporary construction areas

Specific construction laydown areas have not been identified at this time and therefore have not been included in the risk assessment. Temporary laydown areas would be used for site offices, storing materials, plant and equipment, parking for construction works and construction traffic standby. The location of any prospective laydown areas would take into consideration any potential risks and comply with approvals and permit conditions required for the use of these areas.

3.2.4 Extent of study area

The risk assessment considers the individual study areas assessed for each technical study. The study area considers the zone of influence within which impacts could occur.

For example, for the purpose of the landscape and visual impact assessment, the study area is considered to be the area within 500 metres of the proposed infrastructure. Beyond this area, it is anticipated that the combined effects of distance, intervening landform, built form and vegetation will combine to render landscape and visual effects negligible.

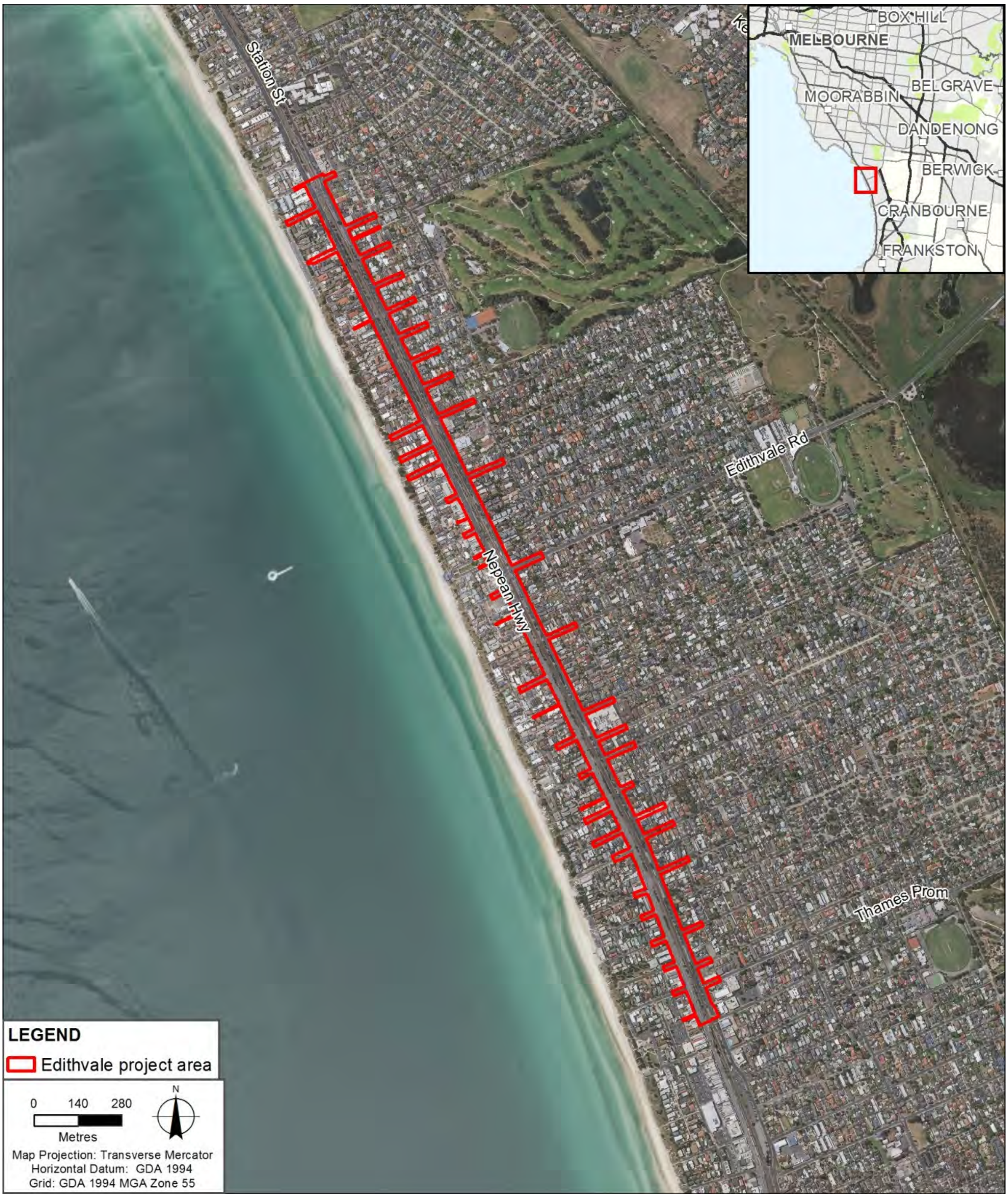


Figure 3 Edithvale project area

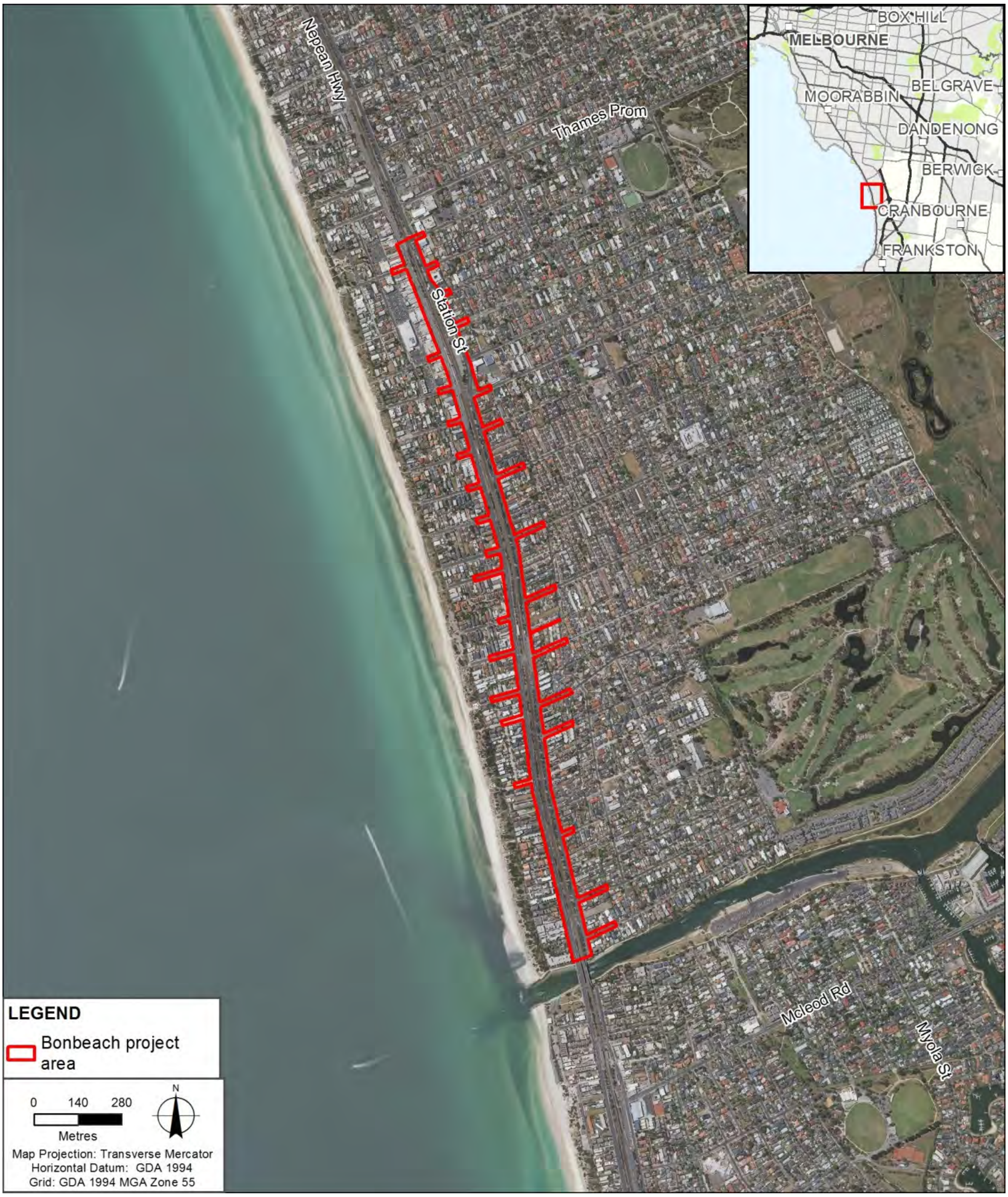


Figure 4 Bonbeach project area

3.3 Project design

3.3.1 Edithvale project design

The Level Crossing Removal Authority (LXRA) proposes to remove the level crossing by lowering the Frankston railway line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level. The trench would be located between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length and 14 metres wide at its narrowest point, widening to 24 metres (including pile widths) at the new Edithvale station platforms.

The rail track would be approximately eight metres below ground level, and sit above the trench base slab and infrastructure to collect and divert rain water from the trench. The maximum depth of the excavation would be 15 metres. Pile depths would be a maximum of 24 metres at the deepest point of the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent unauthorised access by vehicles or people. Decking above the rail trench would provide for the new station building, car parking and a new substation required to ensure sufficient power is available for passenger services on the Frankston railway line. New pedestrian bridges would be constructed to retain pedestrian access across the railway line. A new station is to be constructed with lift, ramp and stair access to the below-ground train platforms.

3.3.2 Bonbeach project design

LXRA proposes to remove the level crossing by lowering the Frankston railway line into a trench under Bondi Road while maintaining Bondi Road at the current road level. The trench would be located between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening to 24 metres (including pile widths) at the new Bonbeach station platforms.

The rail track would be approximately eight metres below ground level, and sit above the trench base slab and infrastructure to collect and divert rain water from the trench. The maximum depth of the excavation would be 15 metres. Pile depths would be a maximum of 24 metres at the deepest point of the trench.

Barriers, fencing and screening would be erected along the trench at road level to prevent access by vehicles or people. Decking above the rail trench would provide for the new station building and car parking. New pedestrian bridges would be constructed to retain pedestrian access across the railway line. A new station building would be constructed with lift, ramp and stair access to the below-ground train platforms.

3.4 Project construction

The key construction activities for the Edithvale and Bonbeach level crossing removal projects include:

- site establishment including:
    - clearing of vegetation and ground levelling
    - establishment of site fencing, staff facilities and temporary construction areas
- protection and/or relocation of utility services
- excavation for piling, foundations and the rail trench
- on site waste management including removal, management and appropriate disposal of excavated soil, rock, stormwater and groundwater

- transport of spoil, excavated material and groundwater offsite
- demolition of existing stations and removal of existing rail and road infrastructure
- construction of bridge/deck structures to support Edithvale Road and Station Street/Bondi Road where they cross the railway line
- construction of base slab and waterproofing, including stormwater tanks
- construction of new station infrastructure including platforms and buildings
- construction of pedestrian overpasses and decking over the rail trench
- installation and commissioning of new rail infrastructure including ballast, overhead line equipment and rail.

In preparation for the main rail occupation, the existing Edithvale station and Bonbeach stations would be closed approximately four weeks in advance. Both projects would be constructed concurrently under the same rail closure which is anticipated to take six weeks.

During the closure of the rail corridor, construction activities would occur 24 hours per day, seven days per week. Additional periodic road closures and lane closures would be required and access along adjacent streets could be restricted. Additional weekend rail shutdowns would likely be required prior to and after the main rail occupation. Construction is expected to be completed within an 18 month period.

3.5 Project operations and maintenance

Following the construction of the Edithvale and Bonbeach level crossing removal projects, the key operation and maintenance phase activities would include:

- operation – monitoring, controlling and operation of the asset in accordance with the rail and road network requirements
- maintenance – routine inspection and monitoring of the condition of the asset, planned routine maintenance and refurbishment work, and unplanned intervention and repair of the asset.

Operation and maintenance activities would be consistent with existing practices and subject to the evolving operational demands of the road and rail networks.

Ongoing operation and maintenance is outside of the scope of this assessment, and is included only as it relates to matters that can be addressed through project design.

3.6 Project duration

For the purpose of the risk assessment, the construction phase of the projects is assumed to be a maximum of 18 months, with some more intense construction works occurring over a shorter duration (approximately six weeks) and that the operations and maintenance phase is assumed to be 100 years. Construction on both projects is assumed to occur concurrently and the estimation of risk levels was based on this assumption.

3.7 Environmental performance requirements

The environmental outcomes that must be achieved during design, construction and operation of the projects are referred to throughout the EES as Environmental Performance Requirements (EPRs). EPRs must be achieved regardless of the ultimate design solutions adopted for the projects.

EPRs have been adopted for the Edithvale and Bonbeach level crossing removal projects and amended to address project specific issues that are specific to the environmental context within which these projects will take place.

The risk assessment was conducted assuming that the projects are designed, constructed and operated within the law and to applicable Australian Standards and the EPRs identified in the risk register, would be achieved.

3.8 Site context

The site setting or context, in which the projects are proposed, is detailed in Table 2 for each specialist area.

Table 2 Context for each specialist study

Study area	Context
Aboriginal cultural heritage	**Edithvale** • Two registered ACH places (one and three stone artefacts) in the geographic region (which is up to one km from the project area). • No registered ACH places in the project area. **Bonbeach** • No registered ACH places identified in the project area or geographic region.
Historic heritage	**Edithvale and Bonbeach** • No National Heritage List, Commonwealth Heritage List, Victorian Heritage Register, Victorian Heritage Inventory sites in project area. • One HO site (Chelsea Clock Tower) in the Edithvale project area but it is not within the construction area. • One HO site (Chelsea Railway Station) in Bonbeach project area but not within the construction area.
Business	**Edithvale** • Edithvale station is located in a predominantly low to medium density residential area. There is a strip of commercial parcels along the northbound lanes of the Nepean Highway (to the west of the rail corridor), parallel to the station. • Clustered in three blocks between Natal Avenue and Derrybeg Lane, as of October 2016 there are 54 businesses operating along the strip consisting of mostly small retail, hospitality and service businesses. **Bonbeach** • Bonbeach station is located in a predominantly low to medium density residential area, with a strip of commercial parcels along the northbound lanes of the Nepean Highway (to the west of the rail corridor), parallel to the station. • Clustered in two blocks between Newberry Avenue and Harding Avenue, as of September 2016 there are 12 businesses operating along the strip. This follows a similar business type profile as Edithvale, however is on a smaller scale and does not include some of local area service businesses such as a post office, supermarket, and pharmacy.
Air quality	**Edithvale and Bonbeach** • Ambient air quality is typical of Melbourne metropolitan air. However, the

Study area	Context
	project area is on the interface between urbanised metropolitan area and pollutant source-free Port Phillip Bay. - A review of the 2013 data for the two closest EPA Air Quality Monitoring Stations (Brighton and Dandenong) indicated that the National Environmental Protection Measure objectives for ambient air quality were met for carbon monoxide, sulphur dioxide and nitrogen dioxide and that annual particulates (PM_{10}) levels were well within air criteria limits. - The nearest residential premises' are located along Nepean Highway and Station Street. - There are 6 diesel freight train movements on weekdays and four on weekends and two diesel V/Line trains on each weekday. Existing operating air emissions comprise carbon monoxide, sulphur dioxide, nitrogen dioxide, particulates (PM_{10} and $PM_{2.5}$), benzene and polycyclic aromatic hydrocarbons and are well below air quality limits.
Noise and vibration	**Edithvale and Bonbeach** - The existing noise and vibration environment is dominated by road traffic noise from the Nepean Highway and the existing rail noise and vibration. - The nearest residential premises' are located along Nepean Highway and Station Street. - Noise monitoring was conducted at 8 sites within the vicinity of the Edithvale level crossing and 4 sites in the vicinity of the Bonbeach level crossing.
Surface water	**Edithvale and Bonbeach** - Both sites are located between the Nepean Highway and Station Street, which are particularly flat and have minimal longitudinal grade. Topographical survey (Lidar) data and site observations indicate that the proposed works would occur along an existing ridge which is elevated above the adjacent road; surface flows generally discharge away from the rail corridor towards Nepean Highway or Station Street. - Run-off from the eastern portion of both project areas drains into the Centre Main Drain via overland flow or the underground stormwater system. The drain discharges stormwater collected north of Thames Promenade into Mordialloc Creek, and from south of Thames Promenade into the Patterson River, both via a stormwater pump station.. There is no immediate formal drainage network to capture stormwater from the rail corridor and runoff currently flows onto the adjacent road networks and eventually flows into the existing piped stormwater system. - Council has advised that the existing infrastructure has no additional capacity to cater for pumped flows if the network is still conveying surface runoff.
Land use and planning	**Edithvale and Bonbeach** - The proposed infrastructure will be located within the existing rail corridor and road reserve. - The land use is zoned Public Use Zone 4. - No property acquisition is required to facilitate the projects. - The Frankston railway line runs the full length of each project area and sits between the Nepean Highway and Station Street. It has two tracks which

Study area	Context
	sit roughly at grade with the road. • Edithvale Station has a car-park for 34 cars and five bike-racks. There are 8 pedestrian crossings within the project area and three other level crossings. • Bonbeach Station has a car-park for 35 cars and 11 bike-racks. There are 6 pedestrian crossings within the project area and three other level crossings.
Traffic	**Edithvale** • The Edithvale Road level crossing is located at the end of Edithvale Road between Station Street and Nepean Highway. Nepean Highway is classified as an arterial highway and is a key north-south movement route in the bayside suburban arterial road network. Station Street is a local road under the management of Kingston Council that serves a localised movement and access function. Edithvale Road is the extension of Springvale Road and is the only arterial road that connects the beachside suburbs between Mordialloc and Patterson River to the Mornington Peninsula Freeway and suburbs to the east • Three bus routes (numbers 706, 858 and 902) travel along Station Street, however none use the level crossing. The 858 and 902 bus routes also use Edithvale Road. Station Street is a Strategic cycling corridor and existing Principle Bicycle Network (PBN) route in the area of the level crossing. Edithvale Road is also an existing PBN route. **Bonbeach** • The Station Street level crossing at Bonbeach is located at the intersection of Nepean Highway, Station Street and Bondi Road. Nepean Highway is classified as an arterial highway and is a key north-south movement route in the bayside suburban arterial road network. Station Street is a local road under the management of Kingston Council that serves a localised movement and access function. Bondi Road is a local road that serves as an access to residential land use and sporting facilities. • There are no bus routes on this section of Nepean Highway or Station Street. Nepean Highway is a strategic cycling corridor and existing PBN route in the area of the level crossing.
Social	**Regional study area– City of Kingston LGA** • The City of Kingston LGA is located approximately 20 kilometres from Melbourne CBD and covers an area of 91 square kilometres in the outer southern suburbs of Melbourne. The LGA had a population of 151,389 persons at the time of the 2016 ABS Census spread across 22 suburbs. Kingston LGA is planning for anticipated population growth, with an expected 185,214 persons by 2036. • The LGA is characterised by its beachside location, densely populated older residential suburbs as well as substantial pockets of industrial and commercial areas. Kingston is one of the state’s main employment centres having one of the largest and most concentrated industrial sectors in Victoria. **Edithvale** • Edithvale has a population of approximately 5,806 persons across an area of 206 hectares (around 2 km^2) within the Kingston LGA. The suburb is predominately residential, with some commercial area along the Nepean

Study area	Context
	Highway. The suburb is bounded by Port Phillip Bay in the west, Rossdale Golf Club in the north, the secondary drain and Edithvale-Seaford Wetlands Environmental Area in the east, and residential land to the south. • Key features of the area include the Edithvale Beach and foreshore, Chelsea Public Golf Course, Edithvale Recreation Reserve, Edithvale Commons and Edithvale Primary School. • Settlement in Edithvale occurred around the 1850s when land was primarily used for farming practices. Since then, significant development did not occur until the post-war years, with rapid growth during the 1950s and 1960s. An increase in new dwellings, particularly medium density housing, during the 1990s resulted in an increase in population. The suburb continues to experience steady growth with an increase of approximately 815 persons in the last ten years. **Bonbeach** • Bonbeach is an established residential suburb with a population of approximately 6,416 persons, at the time of the 2016 Census. The suburb covers an area of 279 hectares (around 3 km^2) within the Kingston LGA. The suburb is bounded by the Wannarkladdin Wetlands to the east, Patterson River to the south, Bonbeach beach and foreshore to the west, residential land and Bicentennial Park to the north. • Major features of the suburb include the beach, Bonbeach Life Saving Club, Patterson River Country Club, Bonbeach Sports Reserve, Chelsea Pony Club and Bonbeach Primary School. • Settlement in Bonbeach occurred around the early 1900s, with significant growth in the suburb during the post-war years as housing spread east from the foreshore. Townhouses and villas dominated development during the 1960s and 1970s, and new dwellings during the mid-1990s resulted in an increase in population. Bonbeach continues to experience population growth, with an increase of 1,424 persons since 2006.
Landscape and visual	**Edithvale and Bonbeach** Five landscape character zones were identified (infrastructure corridor, residential, commercial, open space, foreshore). • The infrastructure corridor landscape character zone is a low, dominant form which cuts in a straight line through the landscape, which is parallel to Nepean Highway and Station Street. The vegetation within the infrastructure corridor is considered to be an important contributor to a sense of place due to it being the primary location where this low, endemic coastal landscape vegetation occurs. • The residential landscape character zone comprises old and new residences, bisected by the infrastructure corridor. Newer residences are more common on the bay side of the corridor. Residences range from single storey to four storeys in height. Limited street tree planting exists. • The commercial landscape character zone comprises a small, linear area containing shops, small businesses and cafes and restaurants. Most commercial properties are one or two storeys with residences on the second storey. There is little setback from the road and no street trees. • The open space landscape character (Edithvale only) comprises Beeson Reserve, which is a flat, linear park in the centre of the project area and Regents Park on the northern boundary of the project area. Beeston

Study area	Context
	Reserve contains a war memorial and is an important gateway between the station and the coast. - The foreshore landscape character forms part of the Aspendale to Carrum Foreshore Reserve which is a long, coastal strip of low dunes and coastal vegetation. This is a highly valuable recreational reserve supporting the Edithvale and Bonbeach Life Saving Clubs. Residences back onto the foreshore.
Ecology	**Edithvale** - Using the precautionary approach it has been assumed that all native vegetation will be removed by construction: o 20 patches of Coast Banksia Woodland (1.12 h) and one patch of Coastal Dune Scrub (0.03 h). o Three scattered trees - This equates to a total of 0.3433 habitat hectares: o 0.3013 habitat hectares (patches) o 0.042 habitat hectares (scattered trees). **Bonbeach** - Using the precautionary approach it has been assumed that all native vegetation will be removed by construction: o 14 patches of Coast Banksia Woodland (1.003 h) three patches of Coastal Dune Scrub (0.05 h) o One scattered tree - This equates to a total of 0.2794 habitat hectares: o 0.2654 habitat hectares (patches) o 0.014 habitat hectares (scattered tree). **Both** - A number of flora species listed under the FFG Act area are present in both of the project areas and may be impacted by works. - Potential exists for trees and shrubs (including non-indigenous, native and exotic species) present within both of the project areas to provide habitat for non-threatened fauna and these could be displaced, injured or killed as a result of the construction process. - CaLP Act listed weed species have been identified in both project areas - several of these species are also recognised as a weed of national significance. - Pest species such as the Red Fox and Feral Cat are likely to be present in the project areas. - The assessment of habitat in construction laydown areas has not been undertaken as these areas have not been definitively selected at this time.
Acid sulfate soils and contamination	**Edithvale** - Potential Acid Sulfate Soils (PASS) was identified ranging from 4 metres below ground surface (mbgs) to15 mbgs that requires management if disturbed as per Victorian EPA guidelines - Volume of waste acid sulfate soils expected to be generated is

Study area	Context
	approximately 43,355 m^3 - No priority sites within the project area or within 500 m radius of the project area. - Other potential sources of contamination adjacent to the Edithvale project area include current and former service stations sites, dry cleaners, commercial/industrial areas, boat storage, a former car dealership, mechanics and an upholsterer. - Presence of fill material ranging from surface to 0.7 mbgs. - Concentrations of selected metals (aluminium, arsenic, chromium (III + IV), iron, manganese, nickel, and zinc), total dissolved solids, ammonia as N, nitrogen, phosphorous (total) exceeded the adopted investigation levels which are considered to be protective of maintenance of ecosystems, potable water supply, agriculture, parks and gardens beneficial uses in the shallow aquifer - Detectable concentrations of PFAS have been reported in soil and groundwater within the project area down hydraulic gradient of the fire station located at 206 Station Street, Edithvale. **Bonbeach** - PASS ranging from 3.5 mbgs to16 mbgs that requires management if disturbed as per Victorian EPA guidelines - Potential of waste acid sulfate soils expected to be generated is 8,515 m^3. - No priority sites within the project area or within 500 m radius of the project area. - Potential sources of contamination in the Bonbeach project area include an electrical substation and historic (potentially uncontrolled) demolition of buildings. - Presence of fill material, ranging from surface to 0.3 mbgs. - Concentrations of selected metals (aluminium, arsenic, chromium (III + IV), copper, iron, molybdenum, nickel and zinc) exceeded the adopted investigation levels which are considered to be protective of maintenance of ecosystems, potable water supply, agriculture, parks and gardens beneficial uses in the Quaternary aquifer. - PFAS has not been reported in the Bonbeach sites investigated in this study. **Both** - The Stage D hazard assessment indicates that the hazard associated with disturbance of CASS at both Edithvale and Bonbeach is 'High' and will requires an Acid Sulfate Soils Management Plan (ASSMP) to be developed in accordance with the EPA 655.1 prior to the construction. - Based on the indicative contamination investigation, it is considered that soil and groundwater within the construction footprint may be contaminated to some degree with metals, polycyclic aromatic hydrocarbons (PAH) and PFAS. - It is estimated 358,094 m^3 of spoil is to be excavated from both project areas.

Study area	Context
Groundwater	**Groundwater elevations / depth to groundwater** - At Edithvale Wetlands, the Quaternary Aquifer (QA) and Upper Tertiary Aquifer (fluvial) (UTAF) show groundwater elevations below sea level (-0.5 mAHD), which equate to depths to groundwater as shallow as 0.2 m bgl and as deep as 1.2 m bgl. - Within the project area at Edithvale and Bonbeach, the QA and UTAF show shallow groundwater elevations above sea level (<1.3 mAHD), which equate to depths to groundwater as shallow as 0.8 m bgl and as deep as 5.9 m bgl. - Given the study area was historically part of a regional swamp, shallow groundwater levels do still occur within the study area. In particular, east of the coastal sand dune at Edithvale, the water table can be close to or at the ground surface during wet climatic periods, typically for short time periods. - While not confirmed through site data, QA groundwater levels near to the coastline are likely to show diurnal fluctuations due to tidal processes. **Groundwater salinity** Groundwater salinity varies depending on aquifer and geomorphic setting: - At Edithvale Wetlands, the QA shows brackish to saline groundwater quality, ranging from 3,300 mg/L (Segment B) to 35,000 mg/L TDS (Segment D) - Elsewhere in Edithvale, the QA shows fresh groundwater quality ranging from 220 mg/L (Segment A1) to 620 mg/L TDS (Segment A2) - At Bonbeach, the QA shows fresh groundwater quality ranging from 300 mg/L (Segment A1) to 657 mg/L TDS (Segment A2) - The UTAF exhibits variable groundwater quality, ranging from 1,300 mg/L (Segment B) to 9,900 mg/L (Segment C) at Edithvale and ranging from 360 mg/L (Segment A1) to 4,700 mg/L (Segment C) at Bonbeach The variability in groundwater quality identified in each aquifer indicates that beneficial uses are unlikely to be consistently relevant in any aquifer across the study area. **Groundwater recharge/discharge** - The study area occurs in a multiple aquifer groundwater setting that is both close to a regional coastal discharge zone (Port Phillip Bay), a local discharge zone (Patterson River) and close to an inland groundwater discharge zone represented by Edithvale Wetlands. **Hydraulic conductivity** - Hydraulic conductivity in the study area is also aquifer dependent and typically averages around 3 m/day for the QA and one to two orders of magnitude lower for the UTAF.
Ecology - Groundwater Dependent Ecosystems (GDEs)	**Edithvale-Seaford Wetlands** - The Edithvale Seaford Wetland (ESW) is a Ramsar listed site. It comprises two distinct wetland areas – the Edithvale Wetlands and the Seaford Wetlands, which are separated by 5 km and the Patterson River. - The Seaford Wetland is physically and hydrologically separated from Edithvale Wetland and is not expected to be affected by the project.

Study area	Context
	• The Edithvale Wetland supports remnant vegetation and a diversity of habitats for a range of flora and fauna species. It provides potential habitat for significant flora species and is known to support a high diversity of significant birds including shorebirds listed under international migratory agreements and/or wetland-dependent birds listed under the *Environment Protection and Biodiversity Conservation Act 1999*. Key species that are regularly supported by the site include Australasian Bittern *Botaurus poiciloptilus,* Curlew Sandpiper *Calidris ferruginea*, Sharp-tailed Sandpiper *Calidris acuminata* and Latham's Snipe *Gallinago hardwickii*. **Other important GDEs** • Wannarkladdin Wetlands are ecologically similar to Edithvale Wetland. The wetland cells range from a deeper pool surrounded by reed beds to shallow open water, bare soil or mud. The Wannarkladdin Wetlands provide habitat for a number of waterbirds and shorebirds and are part of a complex of wetlands (which includes the Edithvale-Seaford Wetlands) that are of national significance. Whilst classed as a high value GDE, Wannarkladdin Wetlands are not of the same ecological value as Edithvale Wetland. They are not managed specifically for conservation and public access is unrestricted. • The Aspendale to Carrum Foreshore Reserve is a largely continuous linear strip of vegetation which is identified by the City of Kingston as a key natural resource area (areas that contain remnant indigenous vegetation). The reserve is characterised by three Ecological Vegetation Classes (Coast Banksia Woodland, Coastal Dune Scrub and Coastal Dune Grassland) which support a diverse range of flora and fauna.

4. Risk assessment

4.1 Identification of risk

4.1.1 Risk workshop

The identification, analysis and evaluation of risk pathways was conducted in two facilitated workshops.

The risk assessments were inclusive of any potential cumulative impacts from the two projects.

Risk workshop 1 was held on 25 July 2017 and risk workshop 2 on 4 September 2017. The following specialist studies were discussed:

Table 3 Risk workshops - specialist studies

Risk Workshops	
Aboriginal cultural heritage (ACH)	Traffic (T)
Historic heritage (HH)	Social (S)
Business (B)	Landscape and visual (LV)
Air quality (AQ)	Ecology (within the project area) (E)
Noise and vibration (NV)	Contaminated Soil/CASS (CL)
Surface water (SW)	Groundwater (GW)
Land use and planning (LUP)	Ecology (groundwater dependent ecosystems and wetlands) (EG)

The outputs from the workshops were entered into a risk register and were used as input data to an Excel spreadsheet model. The workshop was attended by the following AECOM-GHD JV subject matter specialists and engineers, ecology independent peer reviewer and representatives of LXRA:

Table 4 Risk workshop - Attendees

Attendee	Workshop attended	Organisation	Role/area of expertise
[redacted]	1 and 2	LXRA	Senior planning and environment specialist
[redacted]	1 and 2	LXRA	Senior planning and environment specialist
[redacted]	1 and 2	LXRA	Project manager
[redacted]	1 and 2	AECOM-GHD JV – Nation Partners	Stakeholder and community engagement
[redacted]	1 and 2	AECOM-GHD JV	Risk workshop facilitator
[redacted]	1 and 2	AECOM-GHD JV	Risk specialist
[redacted]	1 and 2	AECOM-GHD JV	EES author
[redacted]	1 and 2	AECOM-GHD JV	Ground engineering / tunnelling
[redacted]	1	AECOM-GHD JV – Andrew Long and Associates	Aboriginal cultural heritage
[redacted]	1	AECOM-GHD JV – Lovell Chen	Historic heritage
[redacted]	1	AECOM-GHD JV	Business impacts
[redacted]	1	AECOM-GHD JV	Air quality
[redacted]	1	AECOM-GHD JV	Noise and vibration
[redacted]	1	AECOM-GHD JV	Surface water
[redacted]	1	AECOM-GHD JV	Land use and planning
[redacted]	1	AECOM-GHD JV	Traffic
[redacted]	1	AECOM-GHD JV	Social impact
[redacted]	1	AECOM-GHD JV	Landscape and visual
[redacted]	1	LXRA	Senior project manager
[redacted]	1	AECOM-GHD JV	Rail engineer
[redacted]	1	AECOM-GHD JV	Structural engineer
[redacted]	1	AECOM-GHD JV	Risk workshop minutes
[redacted]	2	AECOM-GHD JV	Coastal Acid Sulfate Soils
[redacted]	2	AECOM-GHD JV	Groundwater
[redacted]	2	AECOM-GHD JV	Contaminated Soil

Attendee	Workshop attended	Organisation	Role/area of expertise
[redacted]	2	AECOM-GHD JV	Ecology and GDEs
[redacted]	2	AECOM-GHD JV	Ecology and GDEs
[redacted]	2	Ecology Australia	Ecology (GDE) independent peer review (observer)
[redacted]	2	AECOM-GHD JV	EES coordinator
[redacted]	2	AECOM-GHD JV	EES author
[redacted]	2	AECOM-GHD JV	Structural engineer

4.1.2 Risk register

A preliminary list of risk pathways was developed prior to each of the workshops by reviewing the technical reports, where available, or directly from the specialists. The preliminary list was provided to workshop attendees for review prior to each of the workshops.

This list was then reviewed at the workshop and amended by input from the workshop participants. The outputs from the workshops were circulated to the attendees for comment and to check for accuracy.

The final list of risks numbered 85 and is shown in the risk register in Appendix B. The risk register contains the risk identification number (ID), the specialist study, the risk name, the risk pathway and the phase at which the risk would be likely to occur (construction or design/operation). The register provides details of the EPRs which were developed during or following the workshops, to reduce the risk further.

4.2 Analysis of risks

In the workshop, each subject matter specialist was asked to estimate a likelihood of occurrence for each component of the risk pathway relevant to their study area using the process described in Section 2.3.3. The likelihoods estimated assume that the projects would achieve the EPRs identified in the risk register, and that projects are designed, constructed and operated within the law and to applicable Australian Standards.

The likelihood of occurrence for each component of the risk pathway was estimated for the construction and design/operational phases of the project (where relevant).

Subject matter specialists were asked to utilise their expert knowledge and assign best estimate consequences under each of the asset categories for each risk pathway relevant to their study area. The relative comparability of impacts in the consequences table allows for additive consequences to be considered under each asset category without unduly overestimating the overall consequence level.

4.3 Evaluation of risks

4.3.1 Risk profiles

The inputs from the workshop were input into an Excel spreadsheet model to produce the following profiles:

- **risk** - showing the prioritised list of risks

- **risk to assets** - showing which of the four asset categories (environment, social, economic and public health and safety) would be affected if the risk were to eventuate
- **risk during project stages -** showing the phase of the project in which the risk is likely to occur (construction or design/operation).

The risk profiles are shown in Section 5 and Appendix C.

The inputs to the risk model are shown in Appendix D.

The profiles provide a visual representation of risk for the project to allow LXRA and project stakeholders to readily compare the level of risk across the project as a whole and at various project stages. The profiles also allow LXRA to evaluate risks and prioritise the implementation of additional management and mitigation for inherently high risk activities.

4.4 Risk treatment

During the risk assessment, project-specific performance requirements were identified to avoid, mitigate or manage adverse environmental impacts.

Where the risk assessments identified risks that were major, moderate or minor, a discussion was had about the efficacy of the EPR and additional management and mitigation measures were identified, if required, and the risk reassessed. The risk assessment, impact assessment and treatment processes were repeated until risks to the environment were reduced to minor or negligible levels with the exception of five moderate risks that could not be mitigated any further.

4.5 Linkage to other technical reports

This report refers to each of the technical reports. The outcomes of this risk assessment have informed the risk assessment, impact assessment and environmental performance requirements detailed in each of the technical reports. In the risk register, each risk has been assigned a unique alpha-numeric identifier which references its study area (e.g. HH3, ACH1, AQ, NV etc.). This allows the risk to be easily identified and linked to its technical report and relevant EPR.

Linkages between specialist studies were identified during the risk workshop to avoid ‘double counting’ of risks.

5. Results

As explained in Section 2.2, risk level is a combination of likelihood and consequence. In some of the risk pathways discussed below, the likelihood of occurrence is 100% and the likelihood of impact is 100%. These are, therefore, considered to be planned events. Although there is no uncertainty about the likelihood of these events, there is still uncertainty about their consequence level and, therefore, they are considered risks and included on the same profile as unplanned events which have both uncertain likelihood and uncertain consequence levels. In this way, a planned event with a likelihood of occurrence of 100% and a moderate (10) consequence level will have the same risk level (10) on the profile as an unplanned event which has a likelihood of occurrence of 10% but a major (100) consequence level (10).

5.1 Risk results

A total of 85 risks to the environment were identified for the construction and operation of both projects. Most of the 85 identified risks apply to both projects, however there are 16 site specific risks for Edithvale, and 13 for Bonbeach.

Table 5 shows a comparison between the initial risk levels and the residual risk levels posed by the projects.

The initial risk levels assume that the initial EPRs identified would be in place to mitigate risk. All risks that were minor or above were reviewed by specialists to identify if any EPRs could be updated or added to reduce risks. The residual risk levels assume that the final EPRs would be in place to mitigate risk.

Table 5 Comparison of initial and residual risk levels for the projects

Risk level	Initial risk	Residual risk
Extreme (>1000 risk level)	None	None
Major (>100 risk level)	None	None
Moderate (>10 risk level)	8	4
Minor (1-10 risk level)	20	18
Negligible (<1 risk level)	57	63
TOTAL number of risks	85	85

5.1.1 Initial risk

In order to reduce a number of moderate risks associated with groundwater mounding and drawdown at Edithvale, various modifications to the design of the rail trench were considered. An EPR was developed to specify the environmental outcomes that must be achieved by the projects with respect to groundwater. This EPR would require modification to the trench design to limit the magnitude and extent of groundwater level change at Edithvale (**EPR_GW2**). Risks were reassessed to confirm that new risk levels associated with these moderate risks were reduced to acceptable levels.

The highest 28 initial risks to the environment (i.e. those with a risk level of 1 or >1) are shown graphically in Figure 5. This graph shows the initial risk to the environment posed by projects with initial EPRs in place.

5.1.2 Residual risk

The same 28 risks (based on their initial risk level) are shown as residual risks in Figure 6 and demonstrate the effectiveness of the final EPRs at reducing risk levels.

In particular, the introduction of an EPR to specify the environmental outcomes that must be achieved by the projects with respect to groundwater would limit groundwater mounding and drawdown at Edithvale. This resulted in the reduction of three of the moderate risks, three of the minor risks to negligible and the reduction of one of the moderate risks to minor.

This graph shows the residual risk to the environment posed by projects with final EPRs in place. The complete risk profiles, showing all risks, are provided in Appendix C.

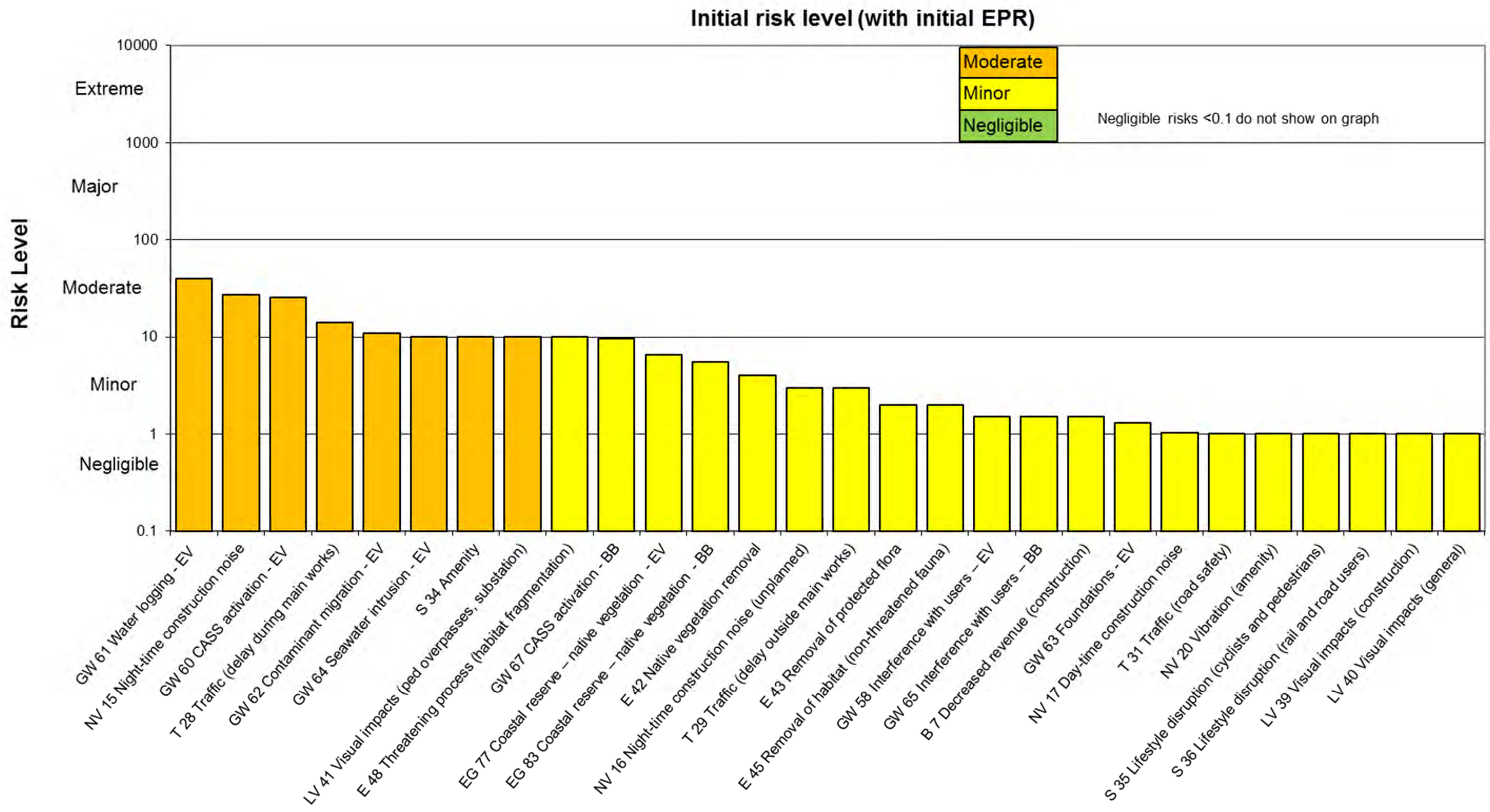


Figure 5 Initial risks posed by the projects (for risks greater than or equal to one)

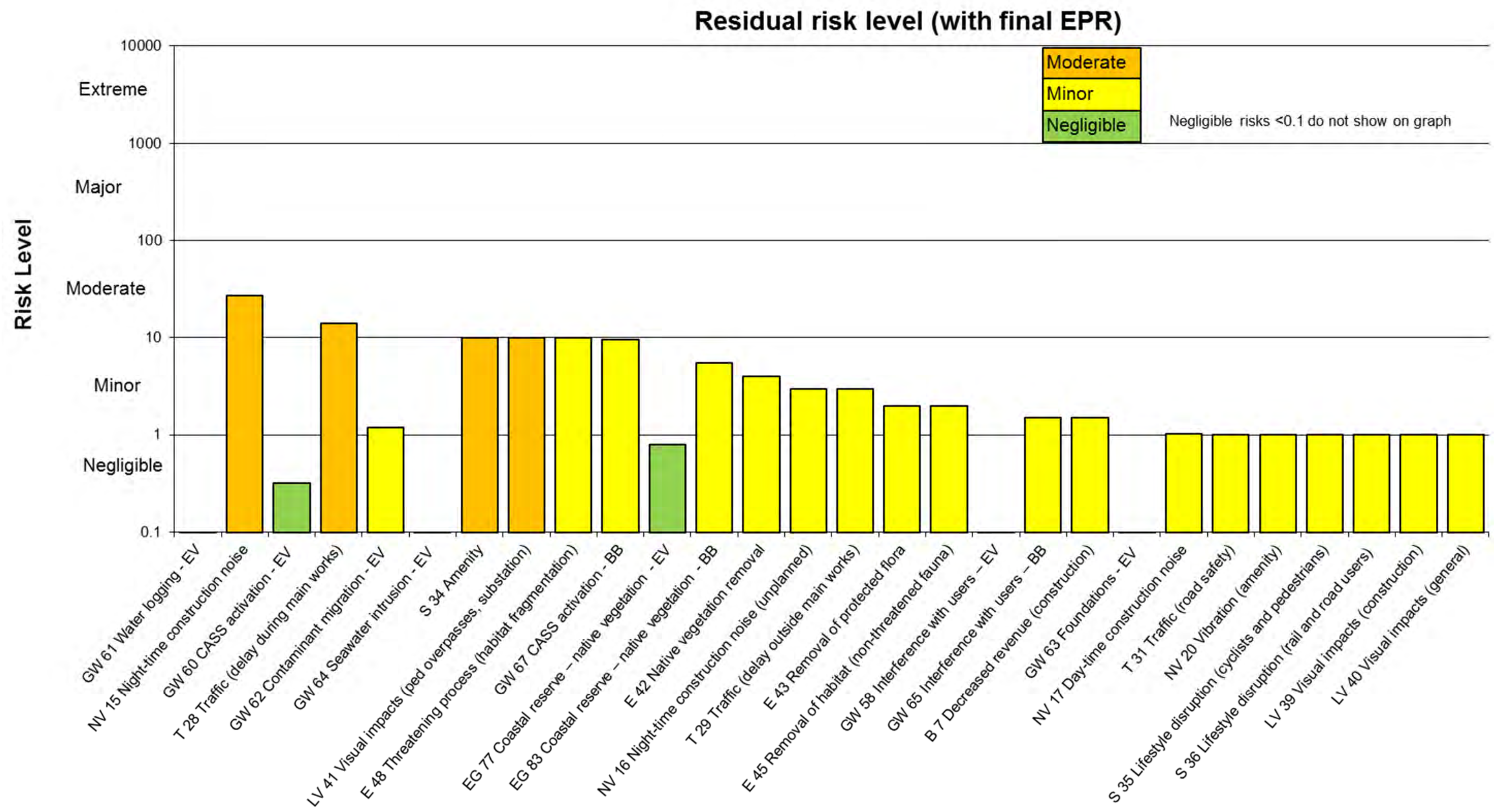


Figure 6 Residual risks posed by the projects (for initial risks greater than or equal to one)

5.2 Moderate residual risks

The four moderate residual risks (level >10) are:

- night-time construction noise
- traffic (delay during main works)
- amenity
- visual impacts (pedestrian overpasses and substation).

These risks relate to general amenity. During construction the most significant impacts to amenity will include traffic and night time noise. During operation there may be long term amenity impacts, associated with visual impacts resulting from the new pedestrian overpasses and substation which will be new visual elements to the area.

Detailed analysis of the impacts and EPRs for each risk is provided in the individual technical reports for social, noise, traffic and landscape and visual.

5.3 Minor residual risks

The eighteen minor residual risk level (1 – 10) events are:

- contaminant migration at Edithvale
- threatening processes (habitat fragmentation)
- coastal acid sulfate soil activation at Bonbeach
- native vegetation removal
- night-time construction noise (unplanned works)
- traffic (delay outside main works)
- coastal reserve – native vegetation at Bonbeach
- removal of protected flora
- removal of habitat (non-threatened fauna)
- interference with groundwater users at Bonbeach
- decreased revenue (construction)
- day-time construction noise
- traffic (road safety)
- vibration (amenity)
- lifestyle disruption (cyclists and pedestrians)
- lifestyle disruption (rail and road users)
- visual impacts (construction)
- visual impacts (general).

The minor risks are grouped generally into those which relate to amenity impacts such as traffic delays, lifestyle disruption, visual changes and noise which could impact on general amenity and local business, vegetation removal within the project area, and changes to groundwater which could affect its beneficial use.

Detailed analysis of the impacts and EPRs for each risk is provided in the individual technical reports.

5.4 Negligible risks

The remaining 63 risks are negligible with risk levels <1. It was considered that these risks will be mitigated as far as possible by the EPRs identified and that further assessment was not required.

The number of negligible risks reflects both the environmental context of the project which is within an existing rail corridor, and LXRA’s extensive environmental management experience in removing level crossings.

LXRA has established procedures and practises to manage construction activities, rail disruption and to keep the community informed, that minimise impacts to the environment and community.

5.5 Residual risk to assets

Figure 7 shows the residual risks in relation to the four asset categories (environment, social, economic and public health and safety) which would be affected if the risks were to eventuate. The complete risk profile, showing all risks, is provided in Appendix C.

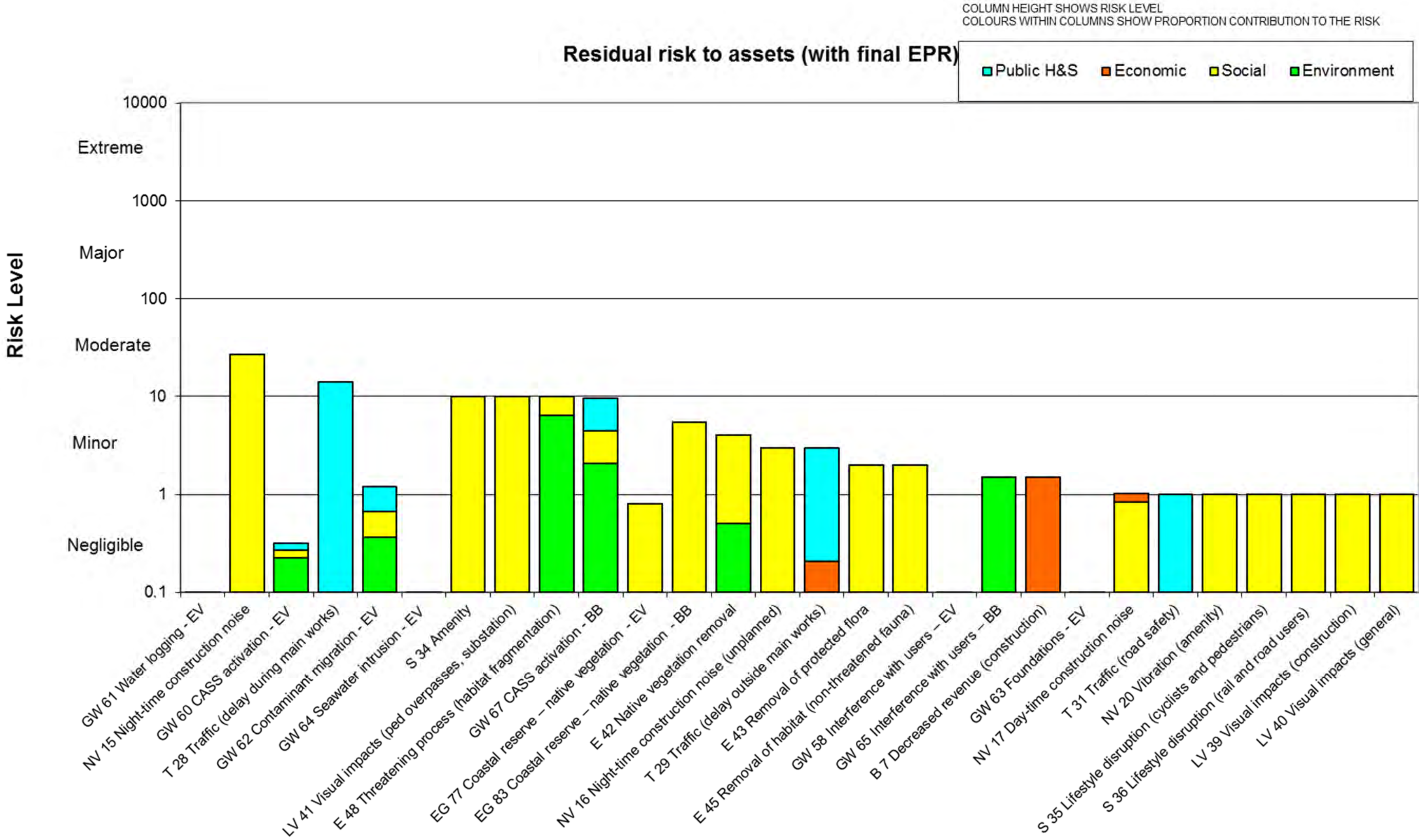


Figure 7 Residual risks to assets (for initial risks greater than or equal to one)

The risk to assets profile shows that the majority of the risk pathways would impact on either the social or environmental asset categories (and sometimes on both). Impact to the public health and safety asset category featured in some of the construction traffic risks, and impacts to local business featured in some of the traffic and business revenue risks.

The moderate level residual risks impact almost solely on the social asset (generally loss of amenity value). One of the moderate risk impacts the public health and safety asset (which also has an amenity component) - it relates to traffic delays during the main works which may result in an increase in collisions.

5.6 Residual risk during project stages

Figure 8 shows the phase of the project in which the residual risk is likely to occur (construction or design/operation).

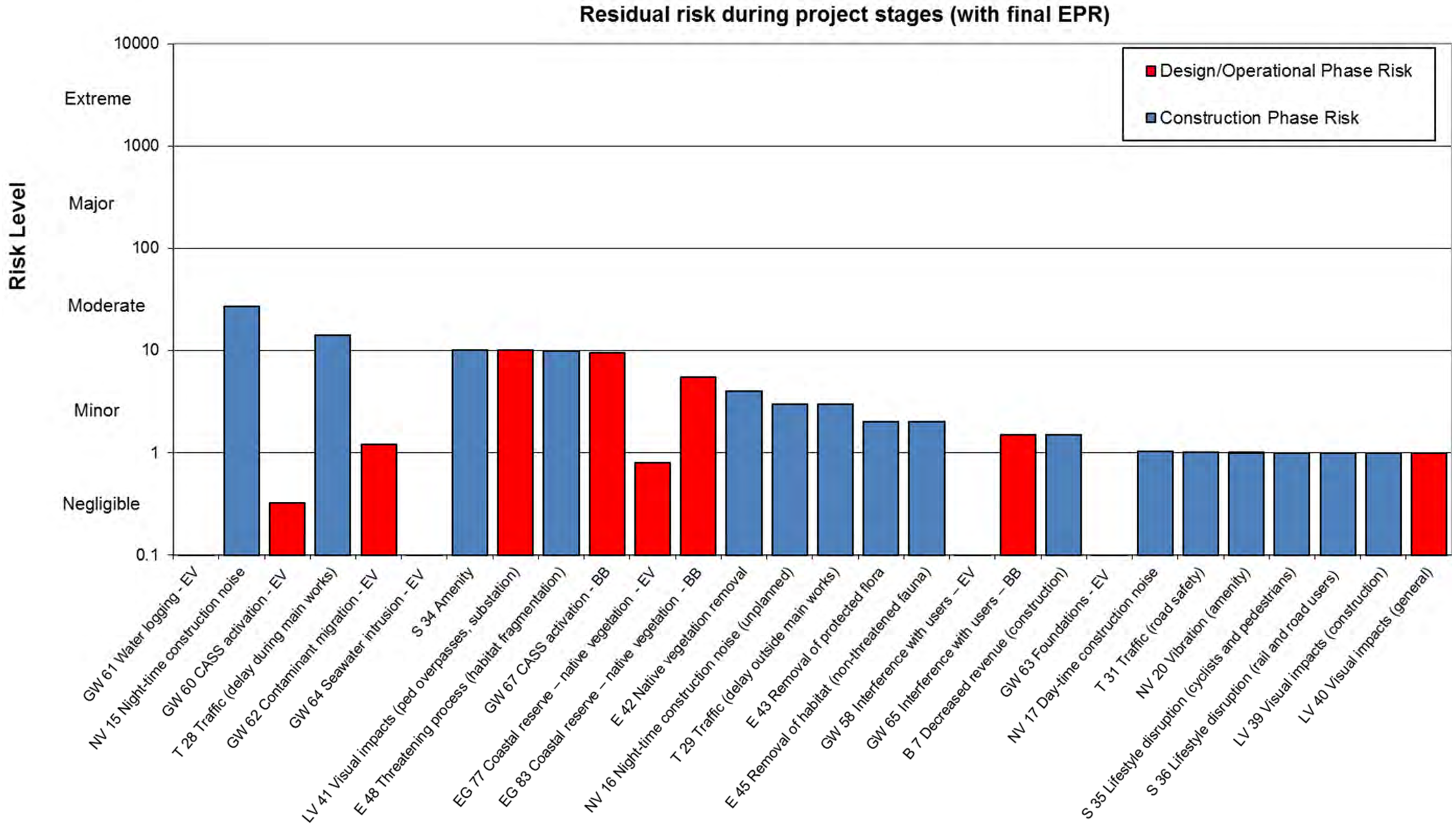


Figure 8 Residual risks during project stages (for initial risks greater than or equal to one)

5.6.1 Construction risks

Of the 22 minor or moderate residual risks, sixteen of the risks occur solely within the construction phase of the project.

During construction, amenity impacts such as traffic delays, noise and vibration and lifestyle disruption will occur and will impact the community. They will peak during the rail occupation when work is scheduled to occur in both the day and the night for a period of approximately six weeks. Outside of the rail occupation there will be some level of impact on the community throughout the 18 month period of construction, but the location, extent and magnitude of impacts will vary. The construction risks associated with noise and amenity would no longer occur once the construction phase was complete.

Native vegetation within the project area will be cleared to allow for construction of the project. This is an unavoidable impact which will be mitigated by off-sets.

5.6.2 Design/operational risks

The majority of design phase risks are associated with long-term changes to groundwater levels and the impact that this could have on beneficial use of groundwater. Impacts could occur within months of construction of the rail trench and continue for the life of the asset. Other operational risks relate to visual impacts associated with the new rail crossing infrastructure.

6. Conclusions

A semi quantitative approach was adopted for the risk assessment. This methodology is consistent with AS/NZS ISO 31000:2009 Risk Management Process in that it is an iterative process which involves risk identification, risk analysis, risk evaluation and risk treatment. The identification, analysis and evaluation of risks were conducted in a series of facilitated workshops.

The outputs from the workshops were entered into a risk register and were used as input data to an Excel spreadsheet model to produce a series of risk profiles. Risk levels assume that environmental management measures are in place to achieve the EPRs identified for the projects.

A total of 85 risks to the environment were identified for the construction and operation of both projects. Most of the 85 identified risks apply to both projects, however there are 16 site specific risks for Edithvale, and 13 for Bonbeach.

The results of the initial risk assessment were used to focus effort for the impact assessment presented in the EES and to prompt consideration of further impact mitigation possibilities. All risks that were minor or above were reviewed by specialists to identify if any EPRs could be updated or added to reduce risks. Risks were reassessed to confirm that new risk levels. The detailed analysis of the potential impacts and EPRs for the key risks is provided in the individual technical reports.

The table below shows a comparison between the initial risk levels and the residual risk levels for the projects.

Risk level	Initial risk	Residual risk
Extreme (>1000 risk level)	None	None
Major (>100 risk level)	None	None
Moderate (>10 risk level)	8	4
Minor (1-10 risk level)	20	18
Negligible (<1 risk level)	57	63
TOTAL number of risks	85	85

In particular, the introduction of an EPR to specify the environmental outcomes that must be achieved by the projects with respect to groundwater would limit groundwater mounding and drawdown at Edithvale. The addition of these EPRs resulted in the reduction of three of the moderate risks, three of the minor risks to negligible and the reduction of one of the moderate risks to minor.

The remaining moderate and minor risks predominantly impact the social or environment assets. These risks typically fall into two categories - those risks related to the amenity impacts associated with construction such as traffic delays, noise and vibration and lifestyle disruption. These risks will peak during the rail occupation when work is scheduled to occur both day and night for a period of approximately six weeks. There will be some level of impact on the community throughout the 18 month period of construction, but the extent and magnitude of impacts will vary. These risks are typical of all level crossing removals. LXRA has extensive experience in managing environmental performance and community expectations during design and construction. To date, 11 level crossings have been removed and 33 are underway.

The other category of risks is associated with long term changes to groundwater levels and the impact that this could have on beneficial uses of groundwater.

7. References

AS/NZS ISO 31000:2009 Risk Management Principles and Guidelines.

Bowden, Lane and Martin, Triple Bottom Line Risk Management, Enhancing Profit, Environmental Performance and Community Benefit, 2001, Wiley New York.

HB 89-2012 Risk Management Guidelines on risk assessment techniques, Standards Australia 30 April 2012.

Appendix A – Consequence table

Qualitative descriptor	Negligible		Minor		Moderate		Major		Extreme
Consequence description	**Minimal, if any impact for some communities. Potentially some impact for a small number (<10) of individuals**		**Low level impact for some communities, or high impact for a small number (<10) of individuals**		**High level of impact for some communities, or moderate impact for communities area-wide**		**High level of impact for communities area-wide**		**High level of impact State-wide**
	0.1	**0.3**	**1**	**3**	**10**	**30**	**100**	**300**	**1000**
ENVIRONMENT **Native vegetation**	Insignificant loss of endangered or very high conservation significance native vegetation (<0.1 Ha) or total loss of native vegetation (<0.5 Ha).		Minor loss of endangered or very high conservation significance native vegetation (>0.1-0.5 Ha) or total loss of native vegetation (>0.5- 5 Ha).		Moderate loss of endangered or very high conservation significance native vegetation (>0.5-5 Ha) or total loss of native vegetation (>5-10 Ha).		Substantial loss of endangered or very high conservation significance native vegetation (>5 -10 Ha) or total loss of native vegetation (>10 -15 Ha).		Significant loss of endangered or very high conservation significance native vegetation (>10 Ha) or total loss of native vegetation (>15 Ha).
ENVIRONMENT **Indigenous flora/fauna species**	Changes to species habitat extent not detectable outside natural variation.		Change to habitat extent that is significant at a project or GDE study area level.		Change to habitat extent that is significant at a GDE study area or Local Government Area) (LGA).		Change to habitat extent that is significant at a bioregional level.		Change to habitat extent that is significant at a State and/or National level.
ENVIRONMENT **Threatened ecological communities**	Changes to threatened ecological communities not detectable outside natural variation.		Loss to the area of threatened ecological community that is >1%, but <10%, of its extent within the LGA.		Loss to the area of threatened ecological community that is >10% of, but <30% of its extent within the LGA.		Loss to the area of threatened ecological community that is >30% of, but <50% of its extent within LGA		Loss to the area of threatened ecological community that is >50% of its extent within the LGA.
ENVIRONMENT **Threatening processes**	No exacerbation of a threatening process.		Exacerbation of threatening process leading to impacts to associated ecological values within the project		Exacerbation of threatening process leading to impacts to associated ecological values within the GDE		Exacerbation of threatening process leading to impacts to associated ecological values within the bioregion.		Exacerbation of threatening process leading to impacts to associated ecological values within at the State

Qualitative descriptor	Negligible	Minor	Moderate	Major	Extreme
		area.	study area or LGA.		and/or National level.
ENVIRONMENT **Ecosystem function**	Ecosystem change not detectable outside natural variation / occurrence.	Measurable changes to the ecosystem components with a minor change in function (no loss of components or introduction of new species that affects ecosystem function).	Measurable changes to the ecosystem components with a moderate change in function (some loss of components or introduction of new species that affects ecosystem function).	Measurable changes to the ecosystem components with a major change in function.	Long term and possibly irreversible damage to one or more ecosystem function.
ENVIRONMENT **Ramsar site**	No measurable change in ecological character. Limit of acceptable change met.	Minor change in ecological character. Limit of acceptable change met.	Moderate change in ecological character. Limit of acceptable change not met for Critical CPS: - physical habitat for waterbirds. and/or - waterbird diversity and abundance (Ramsar Criteria 6).	Major change in ecological character. Limit of acceptable change not met for Critical CPS: - waterbird diversity and abundance (Ramsar Criteria 4). and/or - physical habitat for waterbirds (Ramsar Criteria 4).	Extreme change in ecological character. Limit of acceptable change not met for Critical CPS: - threatened bird species (Ramsar Criteria 2 and 6). and/or - Sharp-tailed Sandpiper abundance (Ramsar Criteria 6).
ENVIRONMENT **Groundwater dependent ecosystems (GDE)**	No notable change in condition and/or extent of surface expression GDE (wetland).	Loss of or impact to a GDE that is of significance within the study area.	Loss of or impact to a GDE that is of significance within the local area.	Loss of or impact to a GDE that is of significance within the bioregion.	Loss of or impact to a GDE that is of significance within the State and/or National context.
ENVIRONMENT **Greenhouse Gas**	Energy use and GHG emissions p.a. is insignificant. Project is near to or on par	Energy use and GHG emissions p.a. is marginal. Project is below NGER reporting requirements.	Energy use and GHG emissions p.a. is measureable. Project triggers or exceeds	Energy use and GHG emissions p.a. is substantial. Project increases Victoria's	Energy use and GHG emissions p.a. is significant. Project increases Victoria's

Qualitative descriptor	Negligible	Minor	Moderate	Major	Extreme
	with the 'no project' scenario.		NGER reporting requirements.	annual transportation sector's GHG emission by more than 1%.	annual transportation sector's GHG emission by more than 10%.
ENVIRONMENT **Air quality**	Applicable air quality standards SEPP (AQM) met across the region.	Isolated, short-term exceedance of SEPP (AQM).	Minor local exceedance of SEPP (AQM).	Minor, short-term exceedance of SEPP (AQM) over a widespread area.	Major, widespread, long-term exceedance of SEPP (AQM).
ENVIRONMENT **Contaminated soil/Acid sulfate soils**	The release of contaminant(s) has no measureable effect on the environment.	The release of contaminant(s) is measureable but does not result in a loss of one or more beneficial uses of the environment.	The release of contaminant(s) into the environment causes temporary and reversible loss of one or more beneficial uses of the environment.	The release of contaminant(s) into the environment causes permanent loss of one or more beneficial uses of the environment on a localised scale.	The release of contaminant(s) into the environment causes permanent loss of one or more beneficial uses of the environment across a large geographic area.
	No disturbance of contaminated soils/rock or ASS.	Handling (including transportation, treatment and/or disposal) of contaminated soils/rock or ASS with negligible risk to human health and/or the environment.	Handling (including transportation, treatment and/or disposal) of contaminated soils/rock or ASS with localised risk to human health and/or the environment.	Handling (including transportation, treatment and/or disposal) of contaminated soils/rock or ASS with risk to human health and/or the environment in a number of localised areas.	Widespread, irreversible risk to human health and/or the environment from handling (including transportation, treatment and/or disposal) of contaminated soils/rock or ASS.
ENVIRONMENT **Land capability and soil contamination**	Negligible soil disturbance and low erosion potential.	Some soil disturbance with minor implications for soil erosion.	Disturbance or changes to surface soil with moderate implications for soil erosion.	Surface soil, covering vegetation, land function significantly compromised.	Extensive impact to surface soil, covering vegetation or land function with irreversible soil erosion.
	Applicable soil standards met locally and across the	Isolated, minor and temporary exceedance of soil quality standards in a	Localised exceedance of applicable soil quality	Major exceedance of soil quality standards in a	Widespread exceedance of applicable soil quality standards in a number of

Qualitative descriptor	Negligible	Minor	Moderate	Major	Extreme
	region.	localised area.	standards.	localised area.	local areas, impacting on regional conditions or with prolonged effects.
ENVIRONMENT **Surface water quality**	Applicable water quality standards met across the region.	Isolated, minor and temporary exceedance of applicable water quality standards that is short lived.	Localised exceedance of applicable water quality standards.	Major exceedance of water quality standards in a local area.	Regional and prolonged exceedance of applicable water quality standards.
ENVIRONMENT **Surface water flow**	Negligible change to waterway and flow regime.	Some change to waterway or flow regime with minor implications.	Changes to waterway or floodplain function with moderate implications.	Waterway, floodplain levels that impact project or river health significantly compromised.	Extensive impact to waterway, floodplain function or flow regime with irreversible disturbance to river health or flood levels.
ENVIRONMENT **Groundwater**	Changes to groundwater levels, flows or quality have no detectable impact.	Changes to groundwater levels, flows or quality within range of typical variation and does not result in loss of one or more beneficial uses of groundwater.	Changes to groundwater levels, flows or quality results in temporary and reversible loss of one or more beneficial uses of groundwater.	Changes to groundwater levels, flows or quality results in permanent loss of one or more beneficial uses of groundwater in a local area.	Changes to groundwater levels, flows or quality results in permanent loss of one or more beneficial uses of groundwater over a widespread area.
SOCIAL **Land Use Planning**	Negligible impact on existing and potential future land uses. Land use changes consistent with planning policies and zoning.	Minor impact on existing and potential future land uses. Land use changes result in minor inconsistency with local or State planning policies and zoning.	Moderate impact on existing and potential future land uses. Land use changes result in significant inconsistency with local planning policies and zoning.	Major impact on existing and potential future land uses. Land use changes result in significant inconsistency with State planning policies and zoning.	Catastrophic and permanent impact on existing and potential future land uses. Land use changes result in complete inconsistency with local or State planning policies and zoning.

Qualitative descriptor	Negligible	Minor	Moderate	Major	Extreme
SOCIAL **Noise**	**Construction** - noise is just audible. **Operation** - no increase in noise level.	**Construction** - noise is audible but within project noise criteria. **Operation** - noise levels increase but comply with project criteria.	**Construction** - noise is occasionally above project criteria at sensitive receptors. **Operation** - noise levels increase slightly and are greater than project criteria.	**Construction** - noise levels above project criteria for extended periods of time at sensitive receptors. **Operation** - noise levels increase significantly and are greater than project criteria.	**Construction** - not applicable. **Operation** - noise levels significantly above criteria on a permanent basis.
SOCIAL **Vibration**	**Construction** - vibration is within applicable limits - no damage to structures. **Operation** - vibration is within applicable limits - no damage to structures.	**Construction** - isolated exceedances of project limits - no damage to structures. **Operation** - isolated exceedances of project limits - no damage to structures.	**Construction** - extended periods of exceedances of project limits - superficial damage to structures. **Operation** - extended periods of exceedances of project limits - superficial damage to <3 structures.	**Construction** - long-term exceedances of project limits - structural damage. **Operation** - long-term exceedances of project limits - superficial damage to >3 structures, structure damage to <3 structures, damage to heritage structure.	**Construction** - vibration causes widespread structural damage. **Operation** - vibration levels significantly above project limits on a permanent basis. Vibration causes widespread structural damage.
SOCIAL **Amenity (Recreation)**	Short term interruptions in recreational use (1 to 2 days).	Activities restricted in a localised area for short-term periods (months).	Restriction on whole or parts of communities to pursue personal recreational pursuits when visiting the area during construction period. No impact post construction.	Long term inability for whole communities to pursue personal recreational pursuits when visiting the area post construction (> 2 yrs).	Long-term inability for the general community to pursue personal recreational pursuits when visiting the area post-construction (>10 yrs).
SOCIAL **Amenity (Traffic/air/ noise/odour/visual**	Short term impacts that alter perception of area as a high amenity place to live	Short term (months) localised impacts that alter perception of area as a	Medium term (1-2 years) regional impacts that alter perception of area as a	Community perception that the area is significantly damaged.	Community perception that the area has experienced major damage.

Qualitative descriptor	Negligible	Minor	Moderate	Major	Extreme
impacts)	/ visit.	high amenity place to live / visit.	high amenity place to live / visit.		
	Region still seen as attractive place to live.	Region not locally seen as attractive place to live.	Region not widely seen as attractive place to live.	Area loses appeal as residential area. Recovery > 2 yrs.	Area is a place to be avoided. Recovery, if at all, >10 yrs.
SOCIAL **Non-Aboriginal Heritage**	No measurable alterations to existing natural and human processes already impacting on heritage sites.	Detectable impact to State or Commonwealth significant site with heritage values largely intact. OR Partial reduction in heritage value intrinsic to non-State / Commonwealth significant site.	Partial reduction in heritage value intrinsic to State or Commonwealth significant site. OR Substantial reduction in heritage value intrinsic to non-State / Commonwealth significant site.	Substantial reduction in heritage value intrinsic to State or Commonwealth significant site. OR Complete loss of heritage value intrinsic to non-State/Commonwealth significant site.	Complete loss of heritage value intrinsic to State or Commonwealth significant site.
SOCIAL **Aboriginal Heritage**	No impact on Aboriginal cultural heritage sites.	Destruction of a place(s) and/or associated cultural values in a deteriorated condition with a high degree of disturbance evident and some cultural heritage remaining.	Destruction of a common occurrence place(s) and/or associated cultural values A place with a limited range of cultural heritage materials and a place in fair to good condition with some degree of disturbance evident.	Destruction of a rare occurrence place(s) and/or associated cultural values. A place with a large number and diverse range of cultural materials. A place with stratified deposits and/or surface spatial patterning that reflects the way in which the cultural materials were deposited.	Destruction of place(s) and/or associated cultural values of exceptional value. A place identified by Aboriginal Victoria and/ or cultural values identified by Traditional Owners of exceptional value that the destruction would be catastrophic.
ECONOMIC **Business activity**	Localised, short term (< 6 months) reduction in business activity. Loss of annual revenue	Short term (6 - 12 months) reduction in business activity in local area. Loss of annual revenues	Medium term (1 to 2 yr) reduction in business activity across a number of businesses over a wider	Long-term (>2 yr) reduction in business activities across a number of business in a regional area.	Permanent reduction in business activity across a number of businesses in a regional area.

Qualitative descriptor	Negligible	Minor	Moderate	Major	Extreme
	<$100,000.	$100,000 to $1,000,000.	area. Loss of annual revenues $1,000,000 to $10,000,000.	Loss of annual revenues $10,000,000 to $100,000,000.	Loss of annual revenues $100,000,000 to $1,000,000,000.
PUBLIC HEALTH AND SAFETY **Roads and traffic**	Negligible adverse impact on traffic conditions and / or negligible decrease in road safety.	Detectable change in traffic conditions and increase risk of collisions by 5%.	Detectable change in traffic conditions and increase risk of collisions by 10%.	Traffic congestion and delays exceed acceptable levels and increase risk of collisions by 20%.	Traffic congestion and delays severely restrict accessibility and increase in risk of collisions by 20% or an increase in number of fatalities.
PUBLIC HEALTH AND SAFETY **Illness/Injury/Fatality**	Potentially some impact to less than 10 individuals.	Minor injury or illness to less than 10 individuals.	Minor injury or illness to between 10 and 100 individuals. Major injury or illness to 1 individual.	Minor injury or illness to between 100 and 1000 individuals. Major injury or illness to between 1 and 10 individuals. 1 fatality or serious injury.	Major injury or illness to between 10 and 100 individuals. Between 1 and 10 fatalities or serious injuries.

Appendix B – Risk register

Table 6 Aboriginal Cultural Heritage risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risks										
ACH 1	Disturbance of known ACH	Disturbance of previously registered Aboriginal cultural heritage places resulting in loss of heritage value	EPR AH1 CHMP	Highly improbable	Major	Negligible	As initial EPR	Highly improbable	Major	Negligible
ACH 2	Disturbance of unknown common ACH	Disturbance of not previously registered common Aboriginal cultural heritage places resulting in loss of heritage value	EPR AH1 CHMP	Possible	Minor	Negligible	As initial EPR	Possible	Minor	Negligible
ACH 3	Disturbance of unknown rare ACH	Disturbance of not previously registered rare ACH places resulting in loss of heritage value	EPR AH1 CHMP	Unlikely	Major	Negligible	As initial EPR	Unlikely	Major	Negligible

Table 7 Historic Heritage risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risks										
HH 4	Disturbance of identified HH	Disturbance of identified historic heritage places (included in the Heritage Overlay) resulting in loss of heritage value	EPR HH2 Heritage overlay sites	Highly improbable	Moderate	Negligible	As initial EPR	Highly improbable	Moderate	Negligible
HH 5	Disturbance of non-identified HH	Disturbance of not previously identified historic heritage places and sites (archaeological places and sites not included in the Victorian Heritage Inventory) resulting in loss of heritage value	EPR HH1 Unidentified historical archaeological sites	Unlikely	Minor	Negligible	As initial EPR	Unlikely	Minor	Negligible
Operation risks										
HH 6	Visual impact on HH	Visual impact of new buildings and barriers along the length of trench to the setting of heritage places.	EPR HH3 Heritage values EPR UD1 Urban design guidelines	Unlikely	Minor	Negligible	As initial EPR	Unlikely	Minor	Negligible

Table 8 Business risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
B 7	Decreased revenue (construction)	Businesses suffer from temporary loss of revenue due to changed traffic conditions and other construction impacts	EPR B1 Business disruption plan EPR AQ1 Air quality (construction) EPR AQ2 Air quality management EPR T1 Transport Management Plan EPR NV2 Construction noise SC1 Community and Stakeholder Engagement Management Plan	Almost certain	Minor	Minor	As initial EPR	Almost certain	Minor	Minor
Operation risk										
B 8	Decreased revenue (operation)	Existing businesses suffer from increased competition from new businesses in the railway station and/or reduced exposure to rail passengers	EPR SC1 Community and Stakeholder Engagement Management Plan EPR UD1 Urban design guidelines	Possible	Negligible	Negligible	As initial EPR	Possible	Negligible	Negligible

Table 9 Air Quality risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
AQ 9	Air quality-dust (amenity)	Off-site dust levels results in perceived loss of amenity	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management	Unlikely	Minor	Negligible	As initial EPR	Unlikely	Minor	Negligible
AQ 10	Air quality-dust (health)	Off-site dust levels above limits causes health impacts	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management	Highly improbable	Minor	Negligible	As initial EPR	Highly improbable	Minor	Negligible
AQ 11	Air quality-plant combustion	Off-site NO_X, SO_X, CO, benzene, polycyclic aromatic hydrocarbons assessed as above SEPP (Air Quality Management) levels resulting in health impacts to sensitive receptors	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management	Almost impossible	Minor	Negligible	As initial EPR	Almost impossible	Minor	Negligible
AQ 12	Air quality-odour	Odour from contaminated soils (including acid sulfate soils) resulting in amenity impacts	EPR CL2 Acid Sulfate Soil Management Plan EPR CL3 Waste management	Possible	Minor	Negligible	As initial EPR	Possible	Minor	Negligible
Operation risk										
AQ 13	Air quality (diesel train emissions)	Diesel train emissions (such as particulates, nitrogen dioxide, sulphur dioxide, carbon monoxide benzene, polyaromatic hydrocarbons) above SEPP Air Quality Management levels resulting in health impacts to sensitive receptors.	No EPR required	Highly improbable	Negligible	Negligible	No EPR required	Highly improbable	Negligible	Negligible

Table 10 Noise and vibration risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
NV 15	Night-time construction noise	Night-time noise during construction exceeds limits causing loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan EPR SC2 Respite and Relocation Policy	Almost certain	Moderate	Moderate	As initial EPR	Almost certain	Moderate	Moderate
NV 16	Night-time construction noise (unplanned)	Unplanned night-time work during construction exceeds noise limits causing loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan	Highly probable	Moderate	Minor	As initial EPR	Highly probable	Moderate	Minor
NV 17	Day-time construction noise	Day-time noise during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan EPR SC2 Respite and Relocation Policy	Highly probable	Moderate	Minor	As initial EPR	Highly probable	Moderate	Minor
NV 19	Day-time construction noise (unplanned)	Unplanned day-time work during construction causes increase to existing noise levels resulting in a loss of amenity at sensitive receptors.	EPR NV2 Construction noise EPR SC1 Community and Stakeholder Engagement Management Plan	Possible	Moderate	Negligible	As initial EPR	Possible	Moderate	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
NV 20	Vibration (amenity)	Vibration exceeds limits resulting in loss of amenity.	EPR NV2 Construction noise EPR NV3 Pre-construction Condition Surveys EPR SC1 Community and Stakeholder Engagement Management Plan	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor
NV 21	Vibration (structure damage)	Vibration during construction results in structural damage.	EPR NV3 Pre-construction Condition Surveys	Very unlikely	Minor	Negligible	As initial EPR	Very unlikely	Minor	Negligible
Operation risk										
NV 14	Night-time operational noise	Night-time noise during operation exceeds limits causing loss of amenity at sensitive receptors.	EPR NV1 Operational noise	Almost impossible	Moderate	Negligible	As initial EPR	Almost impossible	Moderate	Negligible
NV 18	Day time operational noise	Day-time noise during operation exceeds limits causing loss of amenity at sensitive receptors	EPR NV1 Operational noise	Almost impossible	Negligible	Negligible	As initial EPR	Almost impossible	Negligible	Negligible
NV 20	Vibration (amenity)	Vibration exceeds limits resulting in loss of amenity.	No EPR required	Very unlikely	Minor	Negligible	No EPR required	Very unlikely	Minor	Negligible

Table 11 Surface Water risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
SW 22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm event results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding.	EPR SW3 Drainage network - construction EPR SW5 Flood protection - construction	Very unlikely	Moderate	Negligible	As initial EPR	Very unlikely	Moderate	Negligible
SW 23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm event results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW1 Stormwater management - construction	Unlikely	Minor	Negligible	As initial EPR	Unlikely	Minor	Negligible
SW 24	Stormwater runoff	Stormwater runoff is above SEPP limits and enters receiving water bodies.	EPR SW1 Stormwater management - construction	Highly improbable	Minor	Negligible	As initial EPR	Highly improbable	Minor	Negligible
Operation risks										
SW 22	Site dewatering (runoff capacity)	Dewatering of the trenches following a storm event results in a reduction in capacity in the local stormwater infrastructure elsewhere and results in flooding.	EPR SW4 Drainage network – operation EPR SW6 Flood protection - operation	Almost impossible	Moderate	Negligible	As initial EPR	Almost impossible	Moderate	Negligible
SW 23	Site dewatering (runoff quality)	Dewatering of the trenches following a storm event results in stormwater above SEPP limits being pumped to receiving water bodies.	EPR SW2 Water quality - operation EPR SW6 Flood protection - operation	Very unlikely	Minor	Negligible	As initial EPR	Very unlikely	Minor	Negligible

Table 12 Land use risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction and operation risk										
LUP 25	Inconsistent land use	The project is inconsistent with existing or future land use, including relevant land use policy.	EPR LP1 Land use (construction) EPR UD1 Urban Design Guidelines	Unlikely	Negligible	Negligible	As initial EPR	Unlikely	Negligible	Negligible

Table 13 Traffic risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
T 28	Traffic (delay during main works)	Construction (including rail shutdowns) reduces road capacity and/or increases traffic volumes resulting in delays and increased travel time during the piling and main rail occupation.	EPR T1 Transport Management Plan EPR T2 Public Transport Disruption Management Plan EPR T3 Pedestrian and cyclist connectivity EPR T8 Emergency services	Certain	Moderate	Moderate	As initial EPR	Certain	Moderate	Moderate
T 29	Traffic (delay outside main works)	Construction (including rail shutdowns) reduces road capacity and/or increases traffic volumes resulting in delays and increased travel time outside of the piling and main rail occupation.	EPR T1 Transport Management Plan EPR T2 Public Transport Disruption Management Plan EPR T3 Pedestrian and cyclist connectivity EPR T8 Emergency services	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor
T 30	Traffic (dirt on roads)	Plant and spoil trucks deposit construction debris on public roads leading to dust generation and perceived loss of amenity and public health and safety issues.	EPR T7 Debris on roads	Possible	Minor	Negligible	As initial EPR	Possible	Minor	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
T 31	Traffic (road safety)	Construction results in disruption to the transport network and/or increases traffic volumes leading to increased crashes or the perception that area is less safe.	EPR T1 Transport Management Plan	Unlikely	Extreme	Minor	As initial EPR	Unlikely	Extreme	Minor
Operation risks										
T 26	Traffic (operations)	New road network layout and signalling cannot safely and efficiently cater for traffic volumes following level crossing removal, resulting in unacceptable intersection performance and/or increased crashes.	EPR T4 Intersection design and performance	Very unlikely	Major	Negligible	As initial EPR	Very unlikely	Major	Negligible
T 27	Traffic (connectivity)	Connectivity for pedestrians and cyclists is negatively impacted by level crossing removal, resulting in increases to travel distance and/or time resulting in social and business impacts.	EPR T3 Pedestrian and cyclist connectivity EPR T6 Vehicle and pedestrian access	Very unlikely	Moderate	Negligible	As initial EPR	Very unlikely	Moderate	Negligible
T 32	Traffic (change in AQ)	Changes in traffic flows at the level crossing results in air quality impacts.	EPR T4 Intersection design and performance	Highly improbable	Negligible	Negligible	As initial EPR	Highly improbable	Negligible	Negligible
T 33	Traffic (change in noise)	Changes in traffic flows at the level crossing results in noise impacts.	EPR T4 Intersection design and performance	Unlikely	Negligible	Negligible	As initial EPR	Unlikely	Negligible	Negligible

Table 14 Social risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
S 34	Amenity	Construction activities lead to reduced amenity for nearby residents and social infrastructure facilities due to combined impacts from increased noise and vibration, dust, odour, reduced visual amenity, changes to traffic conditions.	EPR SC1 Community and Stakeholder Engagement Management Plan EPR SC2 Respite and Relocation Policy	Certain	Moderate	Moderate	As initial EPR	Certain	Moderate	Moderate
S 35	Lifestyle disruption (cyclists and pedestrians)	Disruption to cycle paths and pedestrian walkways and pedestrian crossings leading to reduced opportunities for community interaction and active lifestyle.	EPR SC1 Community and Stakeholder Engagement Management Plan EPR T1 Transport Management Plan	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor
S 36	Lifestyle disruption (rail and road users)	Disruption to rail and road operations during construction resulting in increased travel times for public transport users and other road users.	EPR SC1 Community and Stakeholder Engagement Management Plan EPR T2 Public Transport Disruption Management Plan	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor

Table 15 LVIA Table

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
LV 37	Lighting	Lighting leads to disturbance to sensitive receptors/fauna and leads to a perceived loss of amenity.	EPR LV3 Light spillage	Possible	Minor	Negligible	As initial EPR	Possible	Minor	Negligible
LV 39	Visual impacts (construction)	Visual impact of construction activities, ancillary facilities and new rail facilities results in perceived loss of visual amenity by rail users.	EPR UD2 Hoardings	Highly probable	Moderate	Minor	As initial EPR	Highly probable	Moderate	Minor
Operation risks										
LV 37	Lighting	Lighting leads to disturbance to sensitive receptors/fauna and leads to a perceived loss of amenity.	EPR LV2 Lighting	Unlikely	Minor	Negligible	As initial EPR	Unlikely	Minor	Negligible
LV 38	Landscape character	Change of landscape character in infrastructure corridor/commercial/residential/open space/foreshore areas resulting in perceived loss of amenity.	EPR LV1 Landscape and visual opportunities EPR UD1 Urban Design Guidelines	Possible	Minor	Negligible	As initial EPR	Possible	Minor	Negligible
LV 40	Visual impacts (general)	Visual impact of changes to rail infrastructure (excluding pedestrian overpasses and substation) results in perceived loss of visual amenity by residents or the community	EPR LV1 Landscape and visual opportunities EPR UD1 Urban Design Guidelines	Highly probable	Minor	Minor	As initial EPR	Highly probable	Minor	Minor

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
LV 41	Visual impacts (ped overpasses, substation)	Visual impact of new pedestrian overpasses (Edithvale and Bonbeach) and substation (Edithvale) results in perceived loss of visual amenity by residents or the community	EPR LV1 Landscape and visual opportunities EPR UD1 Urban Design Guidelines	Certain	Moderate	Moderate	As initial EPR	Certain	Moderate	Moderate

Table 16 Ecology (project area) risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risks										
E 42	Native vegetation removal	Removal of native vegetation (patches and scattered trees) within the project area, impacting native vegetation extent.	EPR FF1 Native vegetation and habitat	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor
E 43	Removal of protected flora	Loss of protected flora species reducing the abundance of that species.	EPR FF2 FFG permits	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor
E 44	Removal of habitat for threatened species	Removal of habitat for threatened flora and/or fauna species within the project area affecting the persistence of the species.	No EPR specified	Almost impossible	Minor	Negligible	No EPR specified	Almost impossible	Minor	Negligible
E 45	Removal of habitat (non-threatened fauna)	Removal of habitat resulting in the displacement, injury or death of wildlife protected under the *Wildlife Act* 1975 causing animal welfare concerns.	EPR FF4 Fauna EPR FF6 Landscaping for wildlife EPR UD1 Urban Design Guidelines	Certain	Minor	Minor	As initial EPR	Certain	Minor	Minor

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
E 46	Disturbance to fauna (project areas)	Increase in noise, vibration and artificial light affecting fauna behaviour within or adjacent to project area resulting in a decline in fauna abundance and/or diversity.	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management EPR NV2 Construction noise EPR SW1 Stormwater management – construction EPR LV2 Lighting EPR LV3 Light spillage	Very unlikely	Minor	Negligible	As initial EPR	Very unlikely	Minor	Negligible
E 47	Threatening processes (weeds, pathogens, pests)	Spread of weeds listed under the CaLP Act resulting in the decline in quality of native vegetation in the rail corridor adjacent to the project area. Spread or introduction of pathogens / pest animals resulting in the exacerbation of a threatening process listed under the FFG Act and EPBC Act.	EPR FF3 Weeds and pathogens	Almost impossible	Minor	Negligible	As initial EPR	Almost impossible	Minor	Negligible
E 48	Threatening process (habitat fragmentation)	Fragmentation of the narrow habitat corridor within and beyond the rail reserve, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR FF1 Native vegetation and habitat EPR FF6 Landscaping for wildlife EPR UD1 Urban Design Guidelines	Almost certain	Moderate	Minor	As initial EPR	Almost certain	Moderate	Minor

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
E 49	Unintended impacts on vegetation and habitat	Unintended impacts on adjacent/retained vegetation and habitat resulting from: - Inappropriate placement of construction stockpiling resulting in unintended impacts to native vegetation and habitat. - Soil compaction or excavation causing root damage and vegetation loss within (or adjacent to) the project area. - Dust generation during construction impacting the health of vegetation. - Spills of chemicals resulting in pollution of native vegetation or habitat (particularly Edithvale Wetland and/or Wannarkladdin Wetland) either through surface or groundwater flows. - Unintended loss of vegetation to be retained from accidental plant / personnel access to designated "No Go Areas" or areas outside of the defined and anticipated project area.	EPR FF5 Protection of retained/adjacent vegetation and habitat	Almost impossible	Negligible	Negligible	As initial EPR	Almost impossible	Negligible	Negligible
Operation risks										
E 46	Disturbance to fauna (project areas)	Increase in noise, vibration and artificial light affecting fauna behaviour within or adjacent to project area resulting in a decline in fauna abundance and/or diversity.	EPR AQ2 Air quality management EPR LV2 Lighting EPR LV3 Light spillage	Highly improbable	Minor	Negligible	As initial EPR	Highly improbable	Minor	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
E 48	Threatening process (habitat fragmentation)	Fragmentation of the narrow habitat corridor within and beyond the rail reserve, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR FF1 Native vegetation and habitat EPR UD1 Urban Design Guidelines	Almost impossible	Moderate	Negligible	As initial EPR	Almost impossible	Moderate	Negligible

Table 17 Contamination / Spoil Management risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risks										
CL 50	Contaminated soil/CASS (residents)	Disturbance, handling, storage or disposal of CASS/contaminated (including asbestos) soil results in adverse health and environmental impacts.	EPR CL1 – SMP EPR CL2 – Acid Sulfate Soil management plan	Unlikely	Moderate	Negligible	As initial EPR	Unlikely	Moderate	Negligible
CL 51	Contaminated soil/CASS (odour)	Disturbance, handling, storage or disposal of CASS/contaminated soil leads to the generation of odorous material and results in a loss of amenity.	EPR CL1 – SMP EPR CL2 – Acid Sulfate Soil management plan EPR SC1 - Community and Stakeholder Engagement Management Plan	Highly probable	Minor	Negligible	As initial EPR	Highly probable	Minor	Negligible
CL 52	Contaminated groundwater	Disturbance, handling, storage or disposal of acidic and/or contaminated groundwater results in adverse health and environmental impacts.	EPR CL4 – Acidic and/or contaminated groundwater (construction)	Very unlikely	Minor	Negligible	As initial EPR	Very unlikely	Minor	Negligible
CL 53	Unknown contamination	Unknown contamination encountered during construction results in environmental, health or amenity impacts.	EPR CL1 – SMP EPR CL4 – Acidic and/or contaminated groundwater (construction)	Unlikely	Moderate	Negligible	As initial EPR	Unlikely	Moderate	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
CL 54	Spill	Fuel/chemical spill results in adverse health or environmental impact.	EPR CL3 – Waste management	Very unlikely	Moderate	Negligible	As initial EPR	Very unlikely	Moderate	Negligible
CL 55	Other waste streams	Management of other waste (solid inert, liquid, organic, packaging and food scraps) results in environmental impact.	EPR CL1 – SMP EPR CL3 – Waste management	Almost impossible	Negligible	Negligible	As initial EPR	Almost impossible	Negligible	Negligible
CL 56	Non-compliance (waste transport/disposal)	Transport or disposal of CASS and/or contaminated soil is not in compliance with EPA Victoria permit/licence and results in an environmental impact.	EPR CL1 – SMP EPR CL2 – Acid Sulfate Soil management plan	Very unlikely	Minor	Negligible	As initial EPR	Very unlikely	Minor	Negligible
CL 57	Contamination (vapour) – EV	Intersection of contaminated soil and/or groundwater resulting in vapour impacts on human health.	EPR CL1 – SMP EPR CL2 – Acid Sulfate Soil management -plan EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR GW3 – Groundwater Management Plan (construction)	Highly improbable	Minor	Negligible	As initial EPR	Highly improbable	Minor	Negligible

Table 18 Groundwater risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Construction risk										
GW 58	Interference with users – EV	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan EPR CL4 – Acidic and/or contaminated groundwater (construction)	Highly improbable	Moderate	Negligible	As initial EPR	Highly improbable	Moderate	Negligible
GW 65	Interference with users – BB	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 - Rail trench design EPR GW3 Groundwater Management (construction) EPR CL4 – Acidic and/or contaminated groundwater (construction)	Very unlikely	Moderate	Negligible	As initial EPR	Highly improbable	Moderate	Negligible
Operation risks										

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 58	Interference with users – EV	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 - Rail trench design	Almost certain	Minor	Minor	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Unlikely	Minor	Negligible
GW 59	Subsidence – EV	Drawdown on the down gradient side of trench could result in subsidence of unconsolidated subsurface sediments resulting in adverse impact to structures.	EPR GW1 - Rail trench design EPR GM1 – Pre Condition Survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Unlikely	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GM1 – Pre Condition Survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Highly improbable	Moderate	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 60	CASS activation – EV	Drawdown on the down gradient side of trench and mounding on upgradient side of the trench could result in changes in groundwater levels, which could give rise to activation of CASS and/or mobilise any existing acidity and groundwater acidification affecting beneficial uses of land and groundwater.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Almost certain	Moderate	Moderate	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR CL5 – Acidic and/or contaminated groundwater (operation)	Possible	Moderate	Negligible
GW 61	Water logging – EV	Mounding on the up gradient side of trench results in increasing the spatial area and duration that the subsurface experiences groundwater levels at or near the ground surface.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Certain	Moderate	Moderate	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Very unlikely	Moderate	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 62	Contaminant migration – EV	Mounding on the up gradient side of trench, drawdown on down gradient side of trench, and groundwater physically diverted either to the north or south along the up gradient side of the trench could alter contamination plume migration adversely impacting on beneficial uses of land and groundwater.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – SMP EPR CL4 – Acidic and/or contaminated groundwater (construction)	Almost certain	Moderate	Moderate	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – SMP EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR CL5 – Acidic and/or contaminated groundwater (operation)	Highly probable	Moderate	Minor
GW 63	Foundations – EV	Mounding on the up gradient side of trench could result in increasing the spatial area and duration that existing subsurface foundations experience groundwater levels at or near the ground surface.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Possible	Major	Minor	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Highly improbable	Major	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 64	Saltwater intrusion – EV	Drawdown on the down gradient side of the trench could result in inland migration of the saline wedge and salinisation of aquifers, resulting in change in beneficial use of groundwater	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	highly probable	Major	Moderate	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Highly improbable	Major	Negligible
GW 65	Interference with users – BB	Drawdown on the down gradient side of trench impacts groundwater availability for groundwater users.	EPR GW1 - Rail trench design	Almost certain	Minor	Minor	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes	Almost certain	Minor	Minor

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 66	Subsidence – BB	Drawdown on the down gradient side of trench could result in subsidence of unconsolidated subsurface sediments resulting in adverse impact to structures.	EPR GW1 - Rail trench design EPR GM1 – Pre-construction condition survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Very unlikely	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GM1 – Pre-construction condition survey EPR GM2 – Repairs to properties due to vibration, subsidence or ground movement	Unlikely	Moderate	Negligible
GW 67	CASS activation – BB	Drawdown on the down gradient side of trench and mounding on upgradient side of the trench could result in changes in groundwater levels, which could give rise to activation of CASS and/or mobilise any existing acidity and groundwater acidification affecting beneficial uses of land and groundwater.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Almost certain	Moderate	Minor	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Almost certain	Moderate	Minor

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 68	Water logging – BB	Mounding on the up gradient side of trench results in increasing the spatial area and duration that the subsurface experiences groundwater levels at or near the ground surface.	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan	Very unlikely	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Very unlikely	Moderate	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 69	Contaminant migration – BB	Mounding on the up gradient side of trench, drawdown on down gradient side of trench, and groundwater physically diverted either to the north or south along the up gradient side of the trench could alter contamination plume migration adversely impacting on beneficial uses of land and groundwater,	EPR GW1 - Rail trench design EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – SMP EPR CL4 – Acidic and/or contaminated groundwater (construction)	Unlikely	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR CL1 – SMP EPR CL4 – Acidic and/or contaminated groundwater (construction) EPR CL5 – Acidic and/or contaminated groundwater (operation)	Unlikely	Moderate	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
GW 70	Foundations - BB	Mounding on the up gradient side of trench could result in increasing the spatial area and duration that existing subsurface foundations experience groundwater levels at or near the ground surface.	EPR GW1 - Rail trench design	Very unlikely	Major	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Very unlikely	Major	Negligible
GW 71	Saltwater intrusion - BB	Drawdown on the down gradient side of the trench could result in inland migration of the saline wedge and salinisation of aquifers, resulting in change in beneficial use of groundwater	EPR GW1 - Rail trench design	Possible	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Possible	Moderate	Negligible

Table 19 Ecology (GDEs) risks

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Operation risks										
EG 72	Edithvale Wetland - EV	Groundwater mounding leading to altered hydrological regime and/or water quality resulting in a change in ecological character (habitat and/or food availability) that exceeds the limit of acceptable change for critical components, processes and systems to the extent that the Edithvale-Seaford Wetlands no longer meet criteria for listing as a Ramsar site.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 - GDE Monitoring and mitigation plan (Edithvale Wetland)	Almost impossible	Extreme	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
EG 73	Listed migratory and threatened species	Groundwater mounding leading to an altered hydrological regime and resulting in change in habitat (wet grassland / mudflats) at Edithvale Wetland to the extent that the site no longer regularly supports listed migratory and or threatened bird species. Species include Sharp-tailed Sandpiper Latham's Snipe, Australian Bittern and Curlew Sandpiper.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 - GDE Monitoring and mitigation plan (Edithvale Wetland)	Almost impossible	Extreme	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
EG 74	Native vegetation - EV	Groundwater mounding leading to altered hydrological regime and/or water quality resulting in loss of native vegetation (patches and scattered trees) within Edithvale Wetland leading to a reduction in the extent of native vegetation in Victoria.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 - GDE Monitoring and mitigation plan (Edithvale Wetland)	Almost impossible	Extreme	Negligible
EG 75	Exacerbate sea level rise - EV	Groundwater mounding leading to altered hydrology which exacerbates or accelerates predicted effects of sea level rise (climate change) resulting in a loss of habitat and change in ecological character of Edithvale Wetland leading to failure to meet the LAC for critical CPS and/or Ramsar listing criteria.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes	Almost impossible	Extreme	Negligible
EG 76	Threatening process - wetland loss - EV	Loss of Edithvale Wetland resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes	Almost impossible	Extreme	Negligible

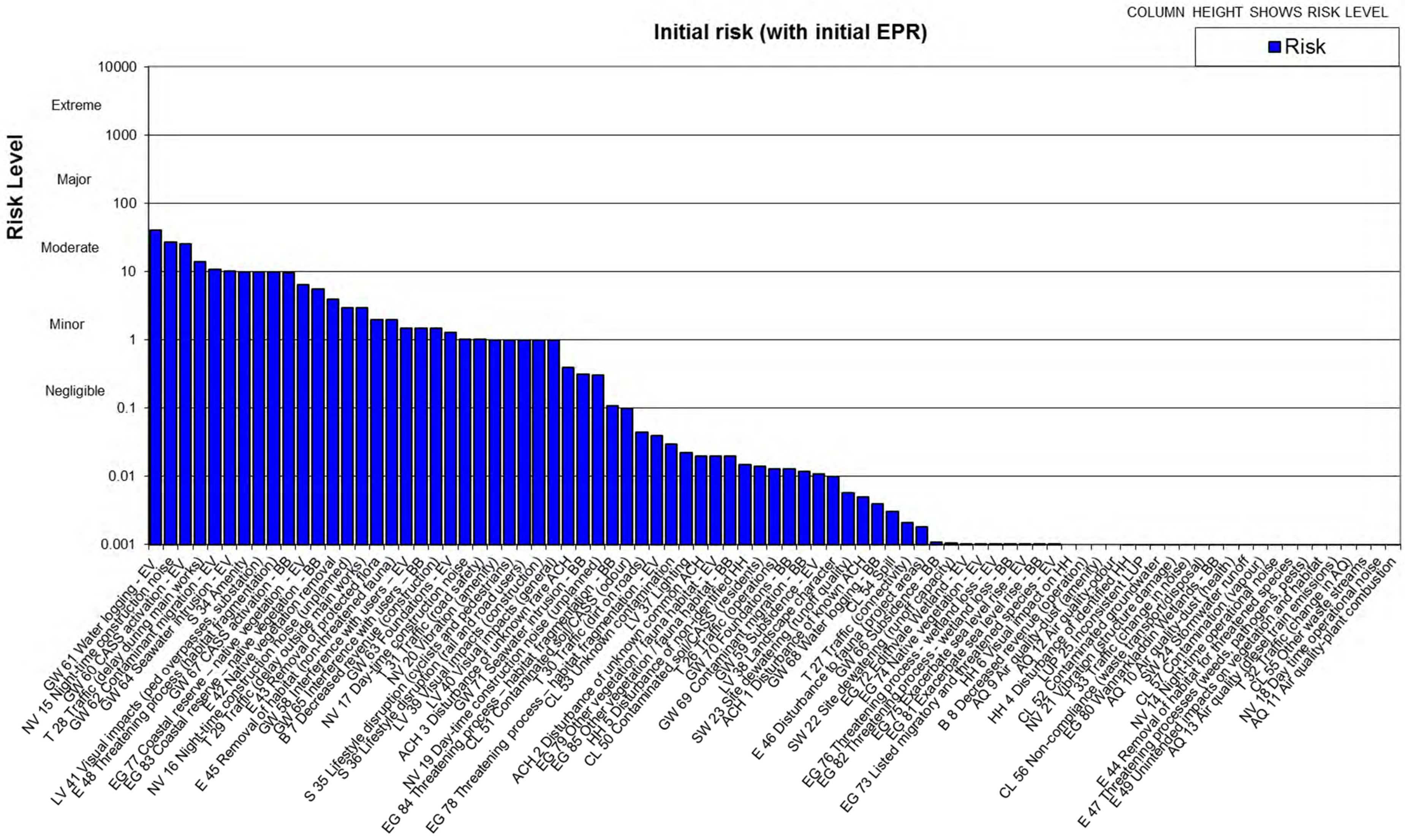
Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
EG 77	Coastal reserve – native vegetation - EV	Groundwater drawdown resulting in the loss of native vegetation and fauna habitat along the coastal reserve leading to a reduction in the extent of native vegetation in Victoria and increased risk of erosion of the foreshore.	EPR GW1 - Rail trench design EPR FF7 – GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Almost certain	Moderate	Minor	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 - GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Almost certain	Minor	Negligible
EG 78	Threatening process – habitat fragmentation - EV	Fragmentation of the narrow habitat corridor of the foreshore reserve, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 - Rail trench design EPR FF7 – GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Possible	Minor	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 - GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Possible	Minor	Negligible

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
EG 79	Other vegetation / fauna habitat - EV	Groundwater change leading to altered hydrological regime and/or changes in water quality resulting in the loss of undocumented remnant vegetation and/or planted vegetation and habitat outside of high value GDEs (i.e. on residential properties) to the east (inland) of the rail corridor.	EPR GW1 - Rail trench design	Possible	Minor	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes	Possible	Minor	Negligible
EG 80	Wannarkladdin Wetlands - BB	Groundwater mounding leading to altered hydrological regime and/or water quality resulting in loss of native vegetation and/or fauna habitat associated with Wannarkladdin Wetlands.	EPR GW1 - Rail trench design	Almost impossible	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan	Almost impossible	Moderate	Negligible
EG 81	Exacerbate sea level rise - BB	Groundwater mounding leading to altered hydrology exacerbates or accelerates predicted effects of sea level rise (climate change) resulting in a loss of habitat and change in ecological character of Edithvale Wetland leading to failure to meet the LAC for critical CPS and/or Ramsar listing criteria.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes	Almost impossible	Extreme	Negligible

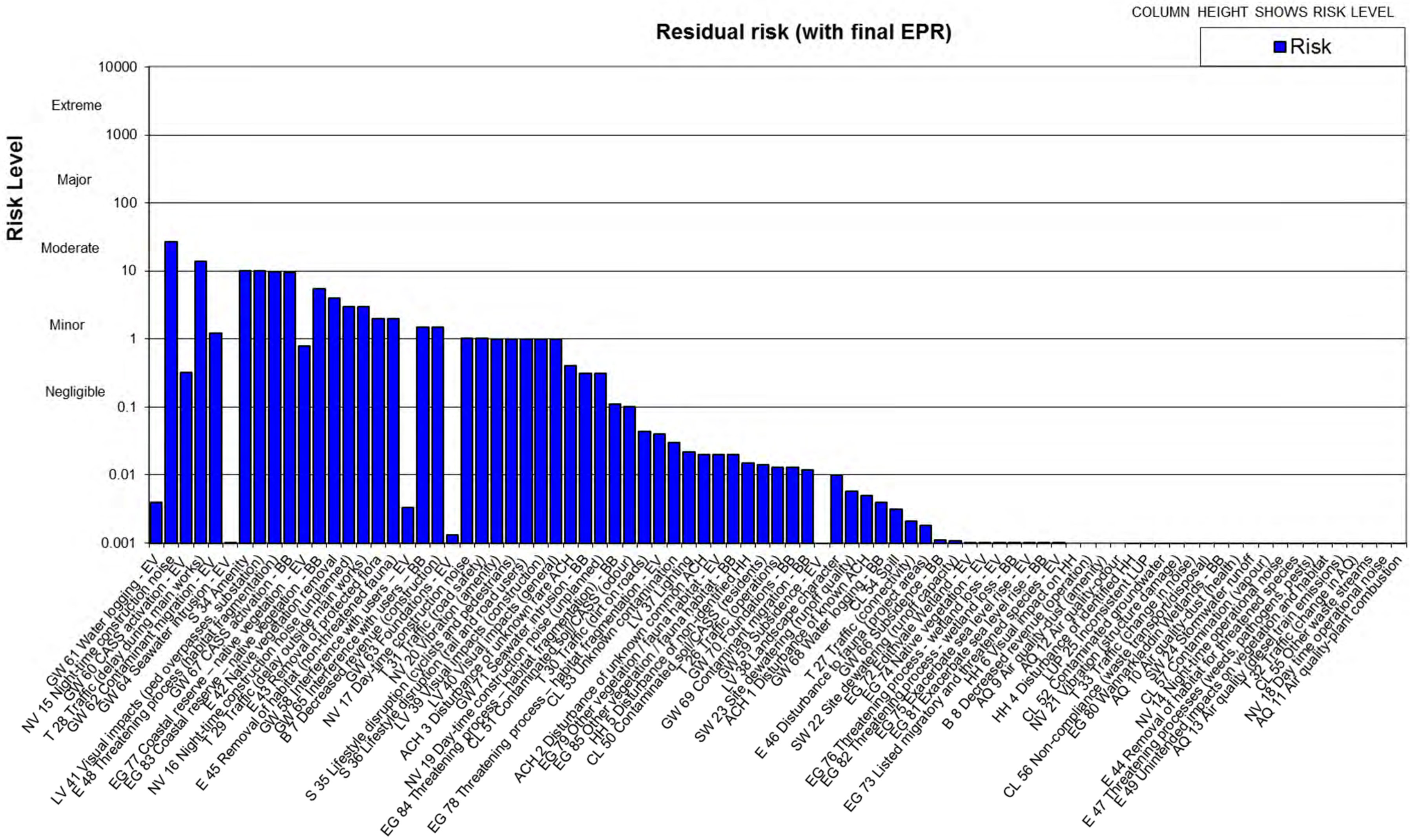
Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
EG 82	Threatening process - wetland loss - BB	Loss of Wannarkladdin Wetlands resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 - Rail trench design	Almost impossible	Extreme	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes	Almost impossible	Extreme	Negligible
EG 83	Coastal reserve – native vegetation - BB	Groundwater drawdown resulting in the loss of native vegetation and fauna habitat along the coastal reserve leading to a reduction in the extent of native vegetation in Victoria and increased risk of erosion of the foreshore.	EPR GW1 - Rail trench design EPR FF7 - GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Almost certain	Moderate	Minor	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 - GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Almost certain	Moderate	Minor

Risk ID	Risk name	Risk pathway	EPR ID (initial)	Initial risk			EPR ID (final)	Residual risk		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
EG 84	Threatening process – habitat fragmentation) - BB	Fragmentation of the narrow habitat corridor of the foreshore reserve, resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 - Rail trench design EPR FF7 - GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Possible	Moderate	Negligible	EPR GW1 - Rail trench design EPR GW2 – Groundwater performance outcomes EPR GW3 – Groundwater Management and Monitoring Plan EPR FF7 - GDE Monitoring and mitigation plan (Foreshore Native Vegetation)	Possible	Moderate	Negligible
EG 85	Other vegetation / fauna habitat - BB	Groundwater change leading to altered hydrological regime and/or changes in water quality resulting in the loss of undocumented remnant vegetation and/or planted vegetation and habitat outside of high value GDEs (i.e. on residential properties) to the east (inland) of the rail corridor.	EPR GW1 - Rail trench design	Possible	Minor	Negligible	EPR GW1 - Rail trench design EPR GW2 - Groundwater performance outcomes	Possible	Minor	Negligible

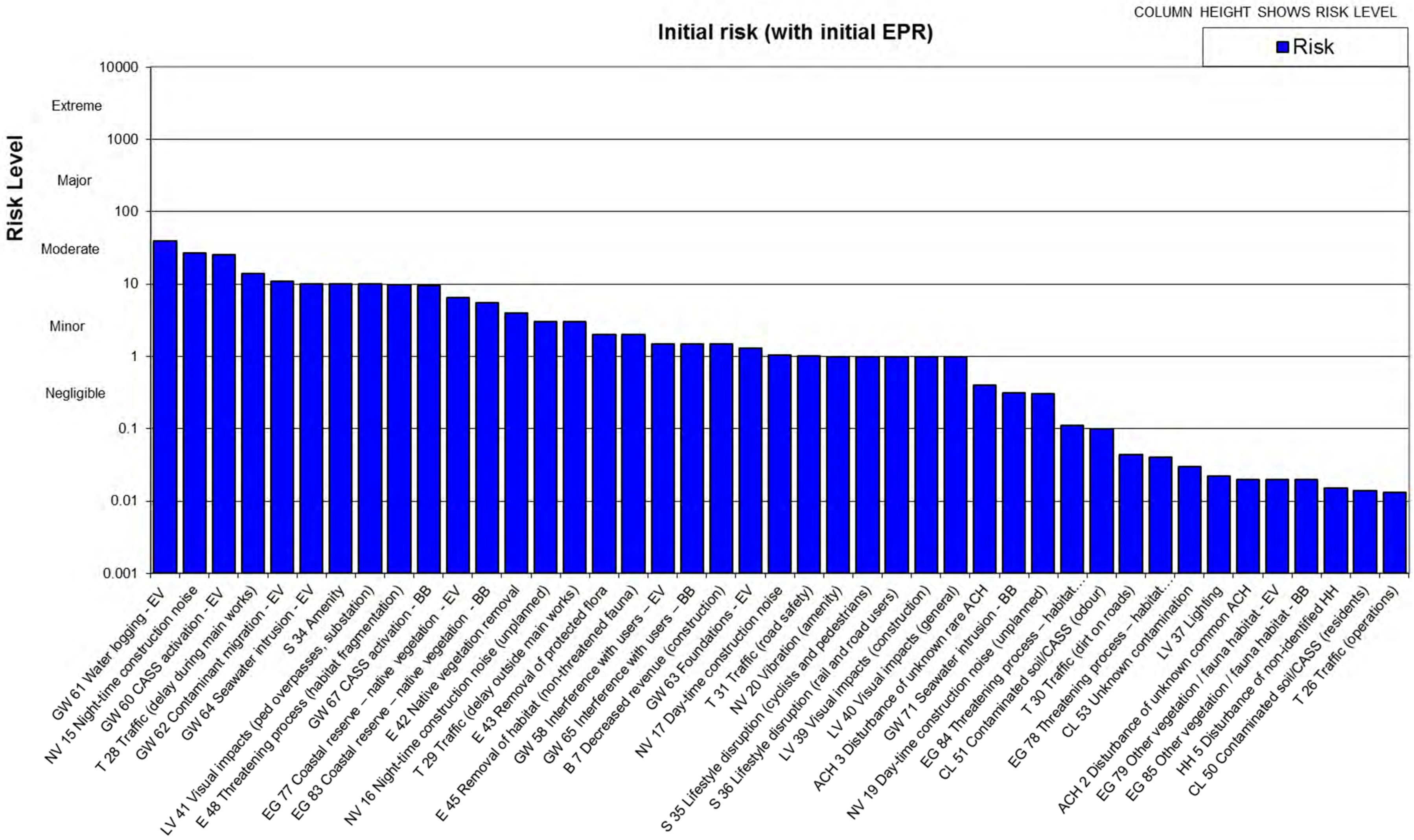
Appendix C – Risk profiles



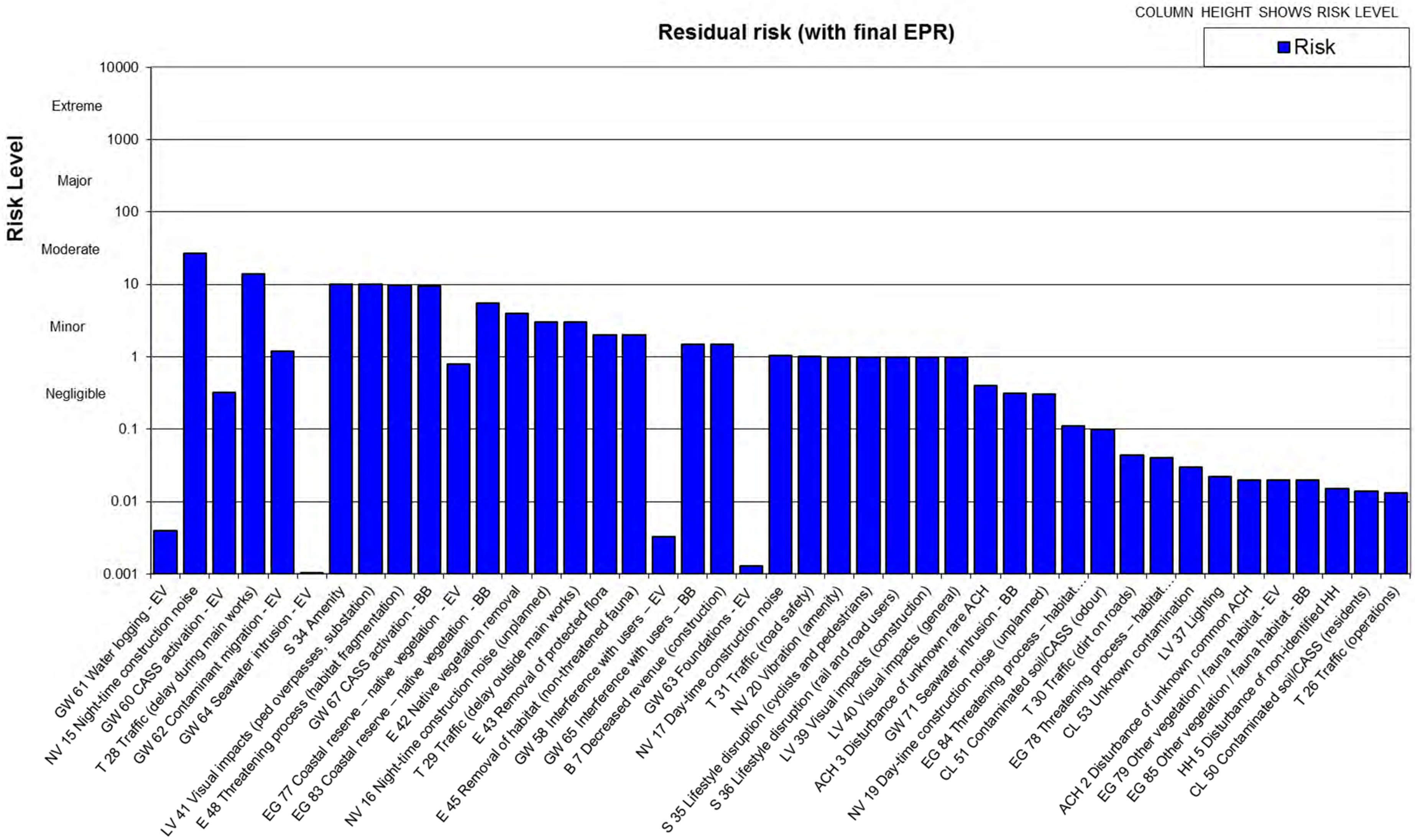
Appendix Figure 1 Initial risk (all risks)



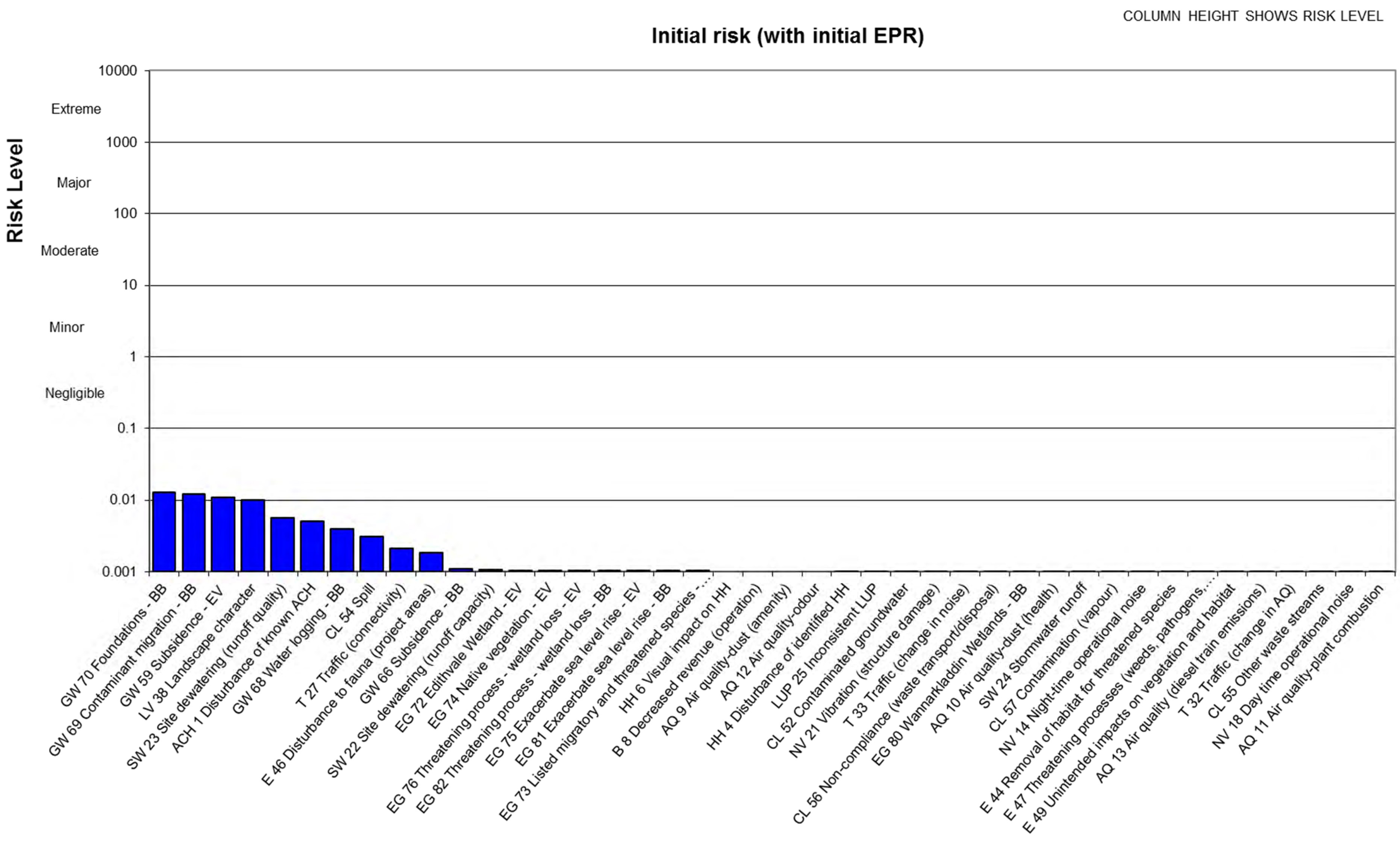
Appendix Figure 2 Residual risk (all risks)



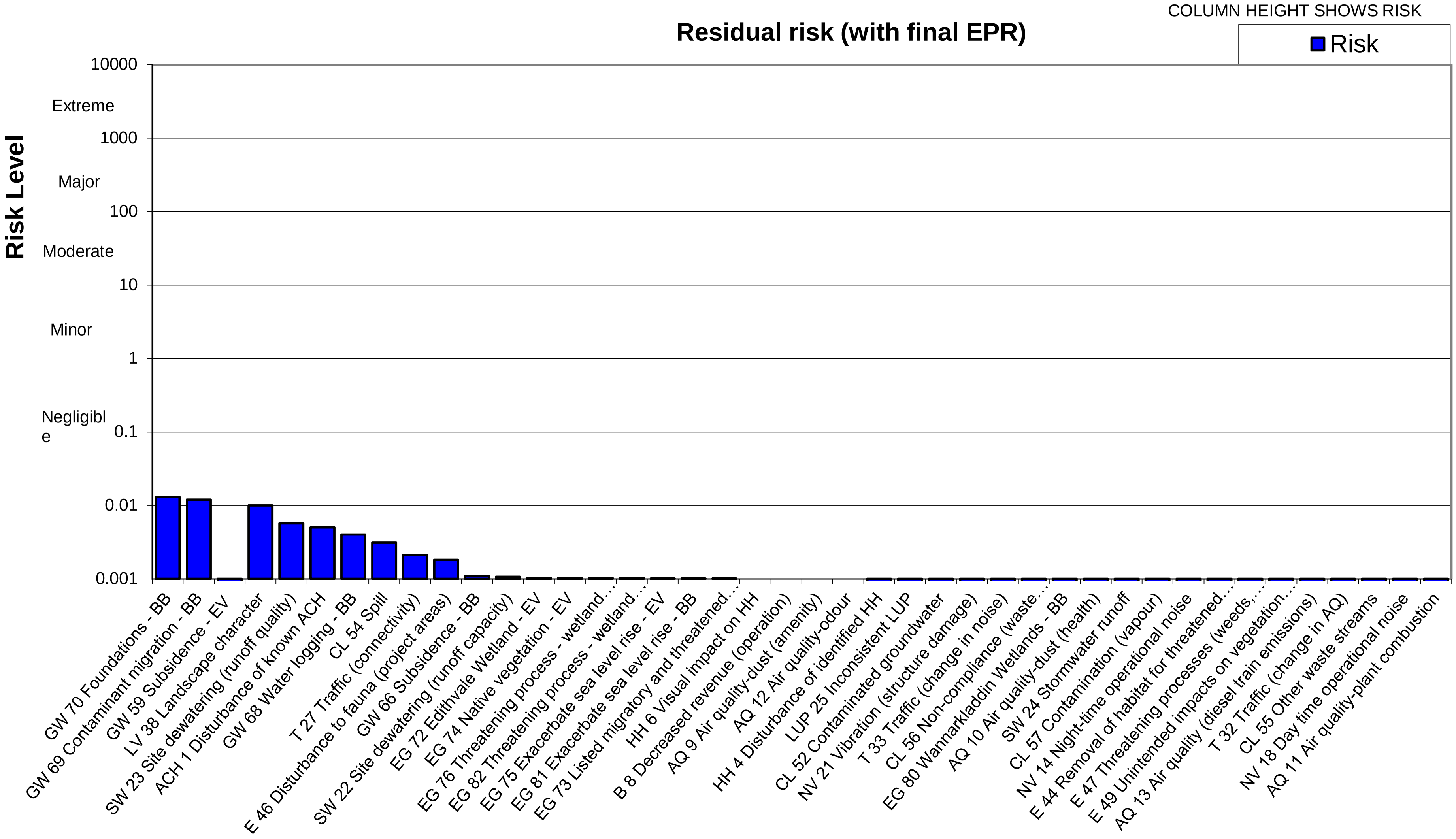
Appendix Figure 3 Initial risk (highest 43 risks)



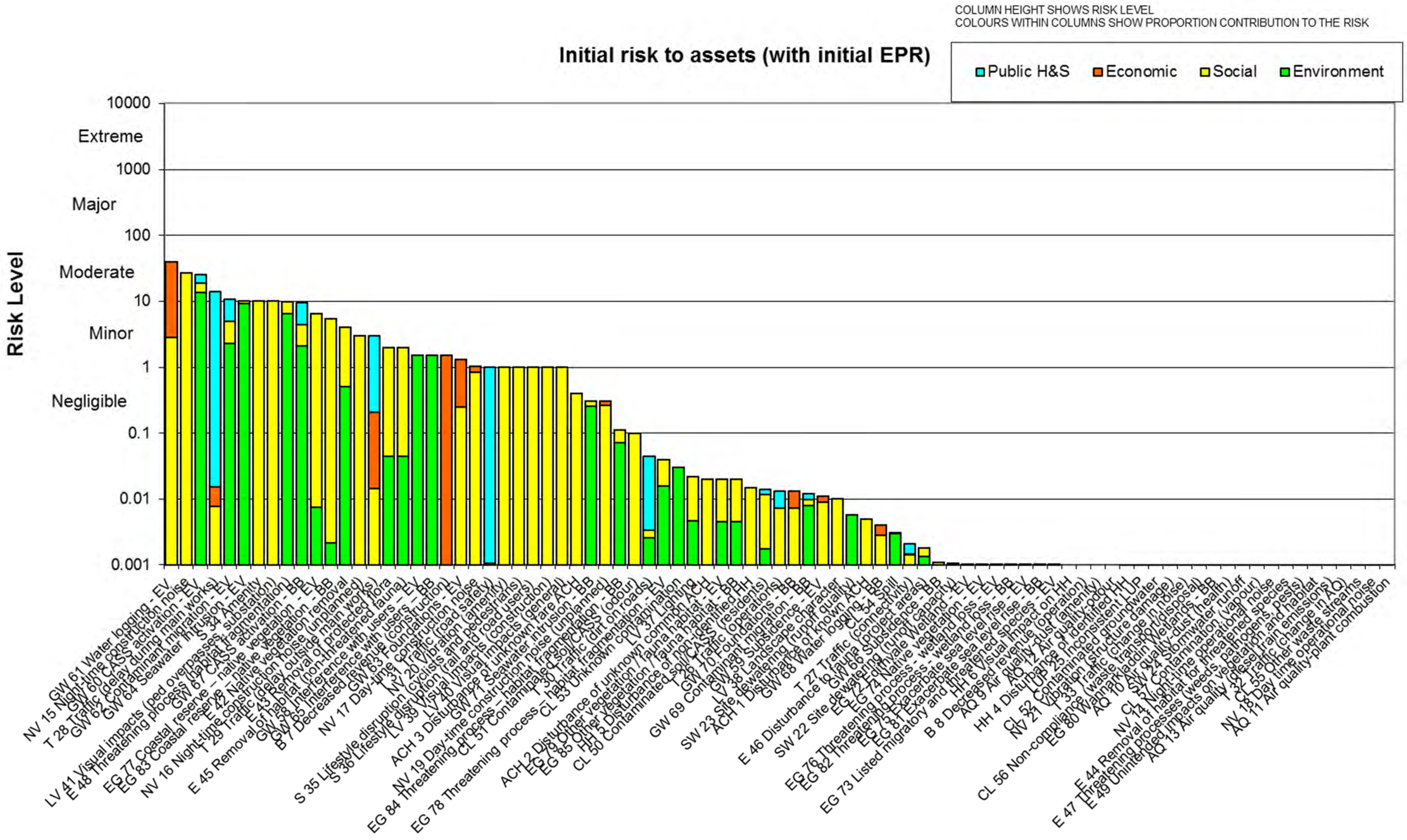
Appendix Figure 4 Residual risk (highest 43 risks)



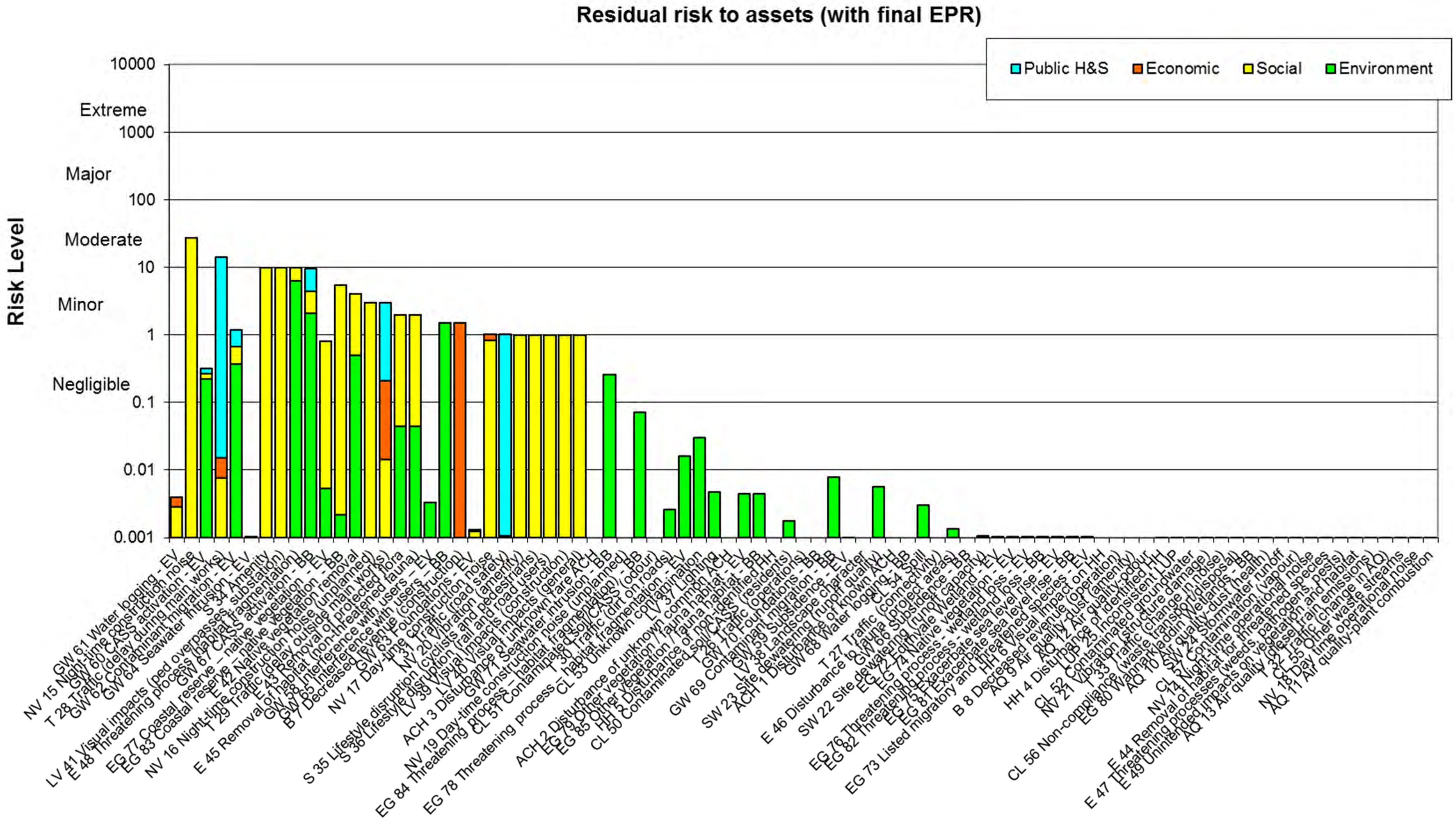
Appendix Figure 5 Initial risk (lowest 42 risks)



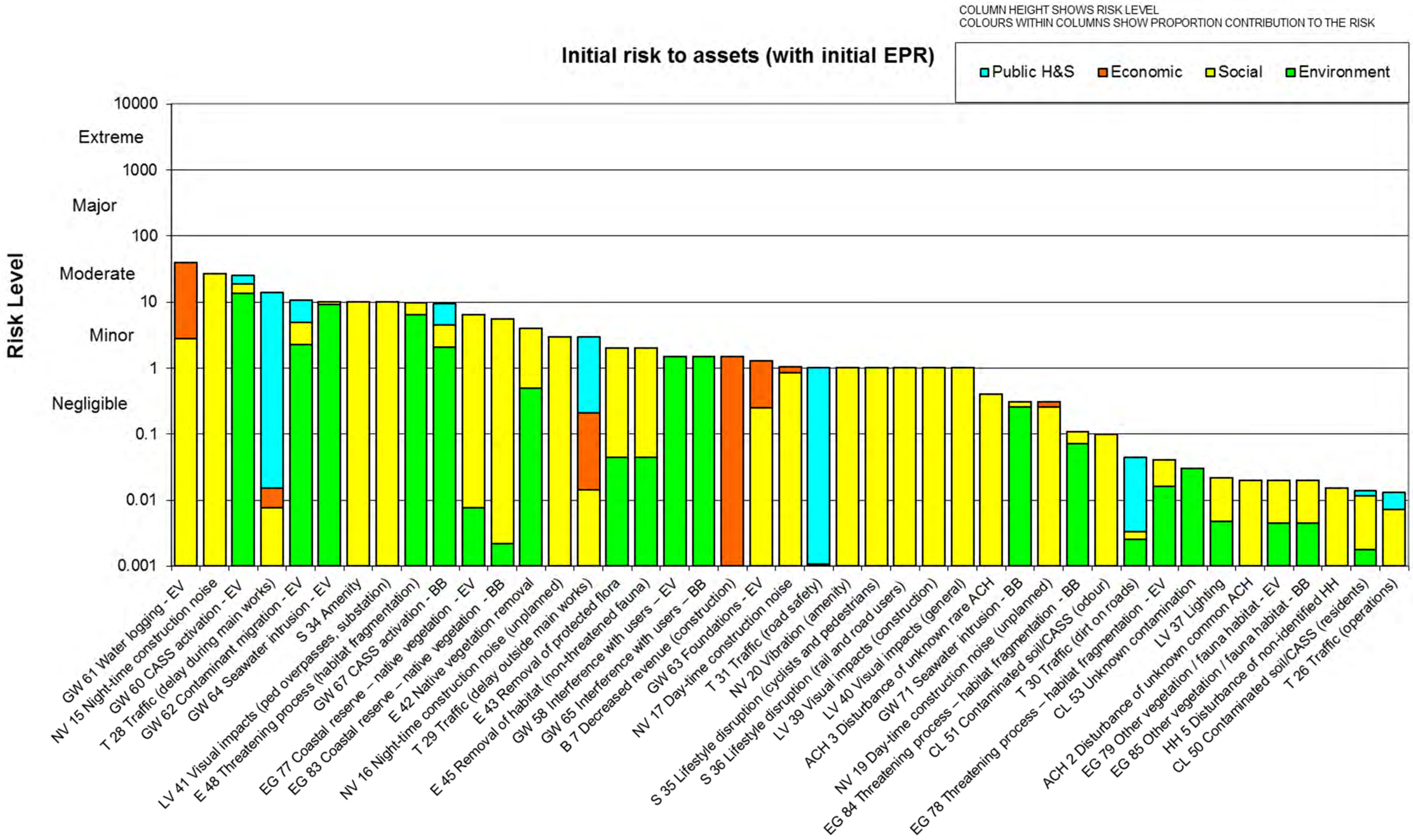
Appendix Figure 6 Residual risk (lowest 42 risks)



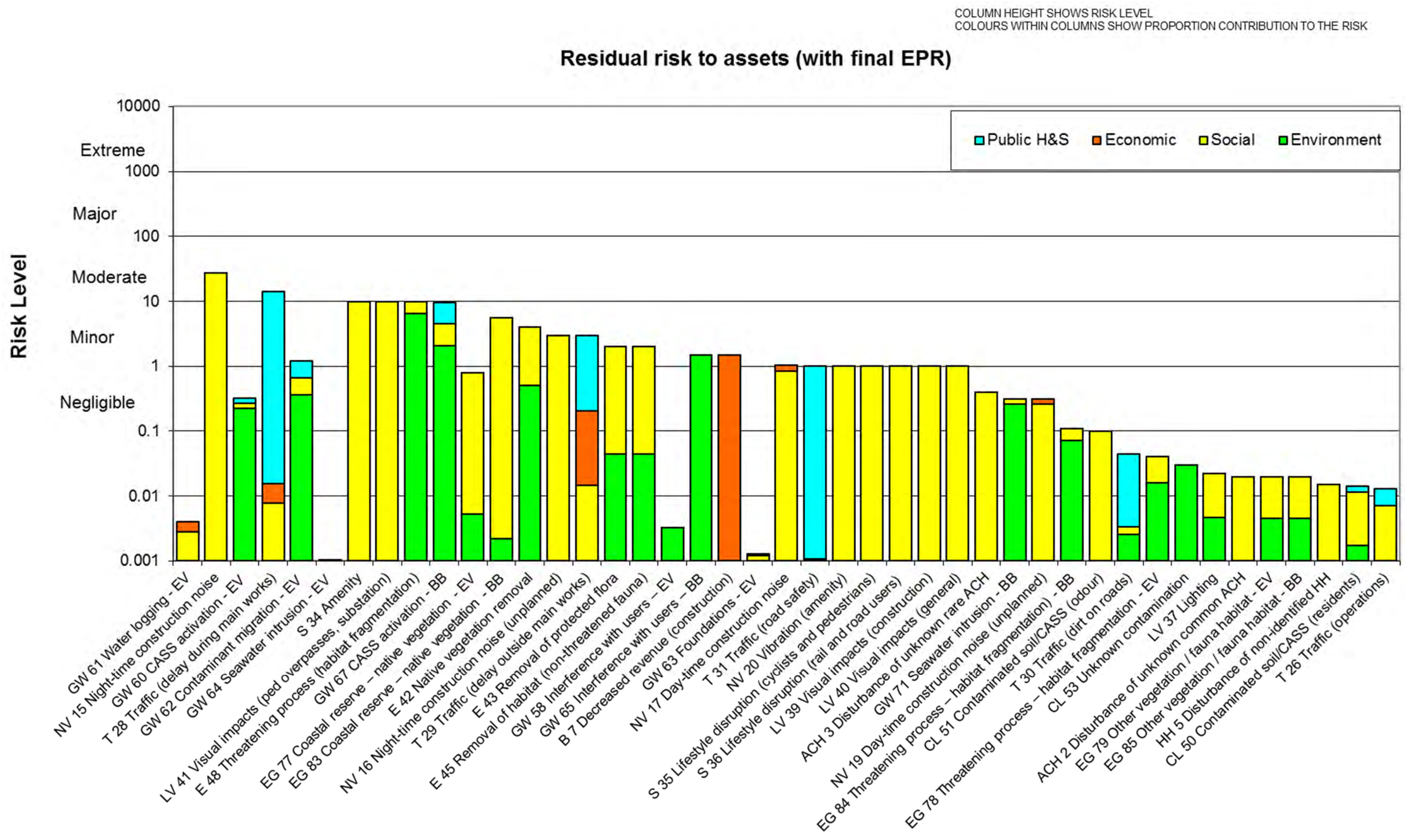
Appendix Figure 7 Initial risk to assets (all risks)


COLUMN HEIGHT SHOWS RISK LEVEL
COLOURS WITHIN COLUMNS SHOW PROPORTION CONTRIBUTION TO THE RISK

Appendix Figure 8 Residual risk to assets (all risks)

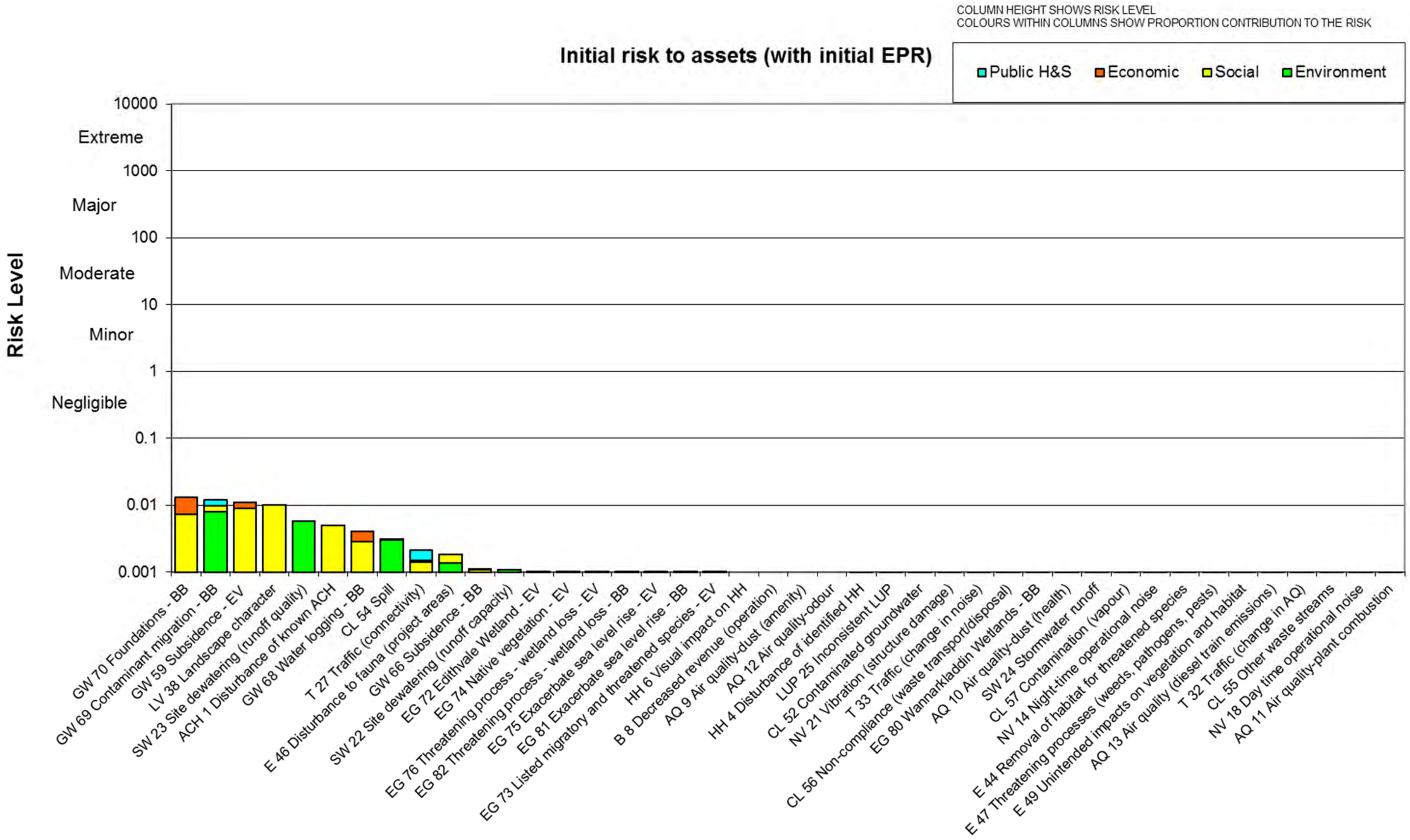


Appendix Figure 9 Initial risk to assets (highest 43 risks)

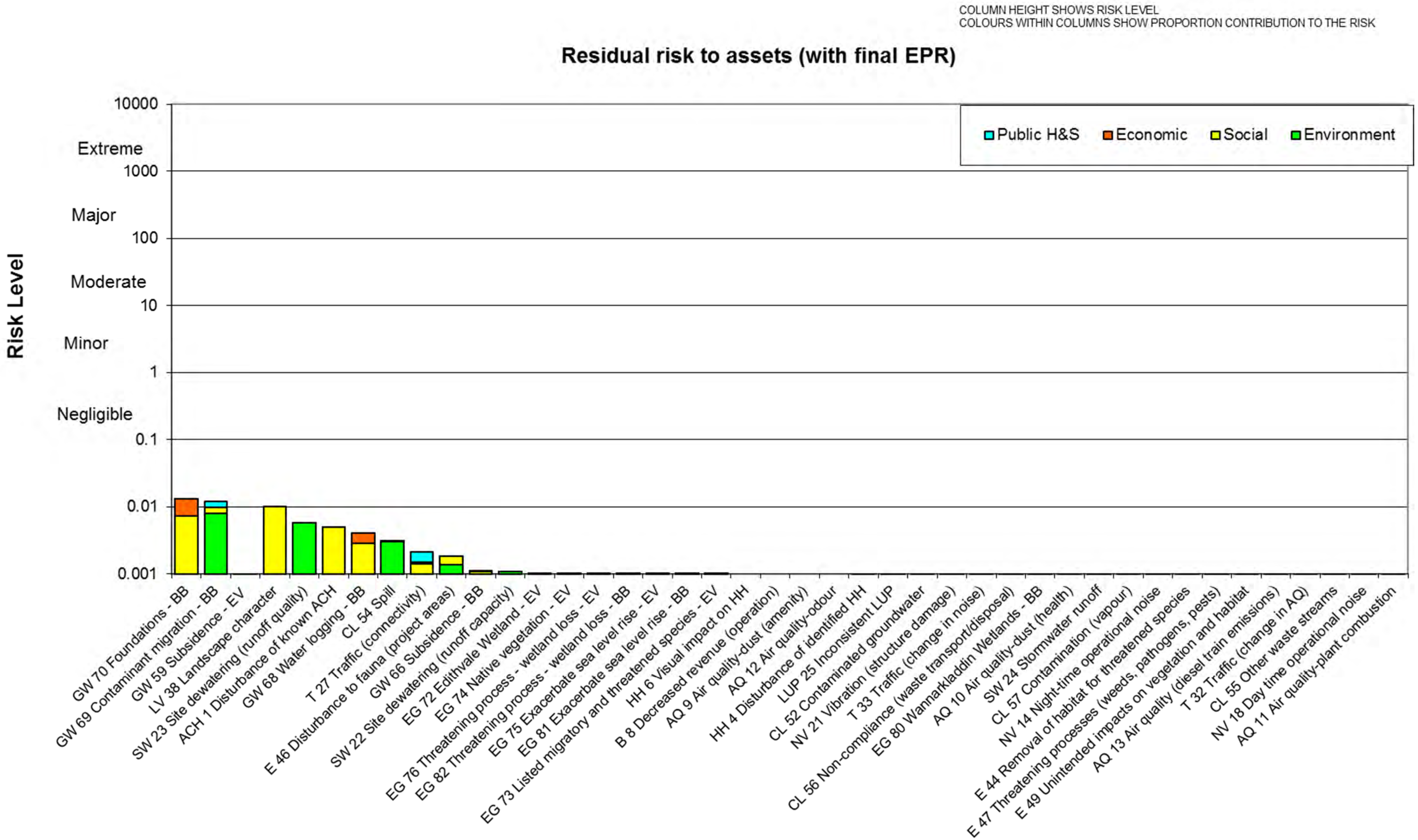

COLUMN HEIGHT SHOWS RISK LEVEL
COLOURS WITHIN COLUMNS SHOW PROPORTION CONTRIBUTION TO THE RISK

Residual risk to assets (with final EPR)

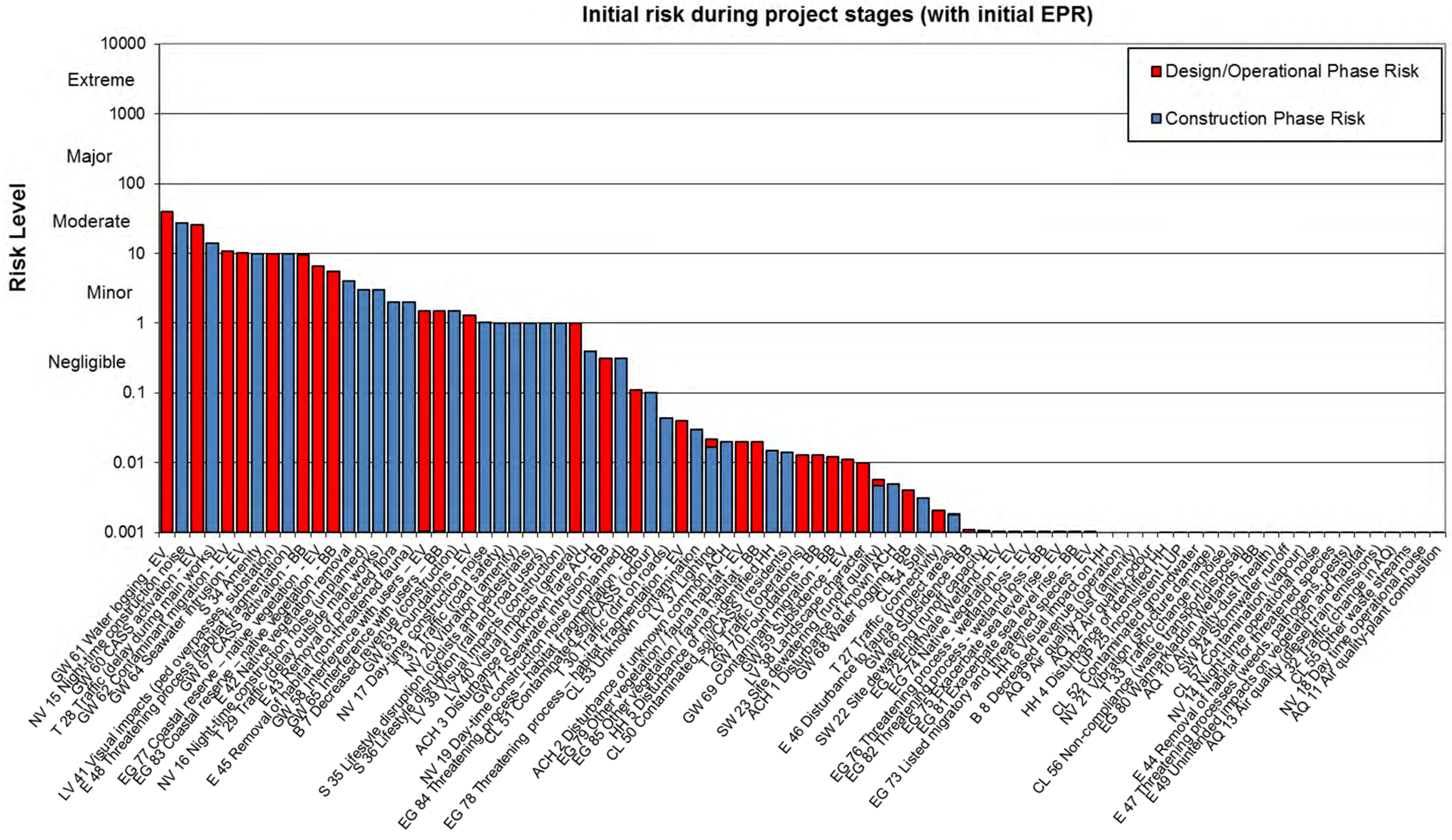
Appendix Figure 10 Residual risk to assets (highest 43 risks)



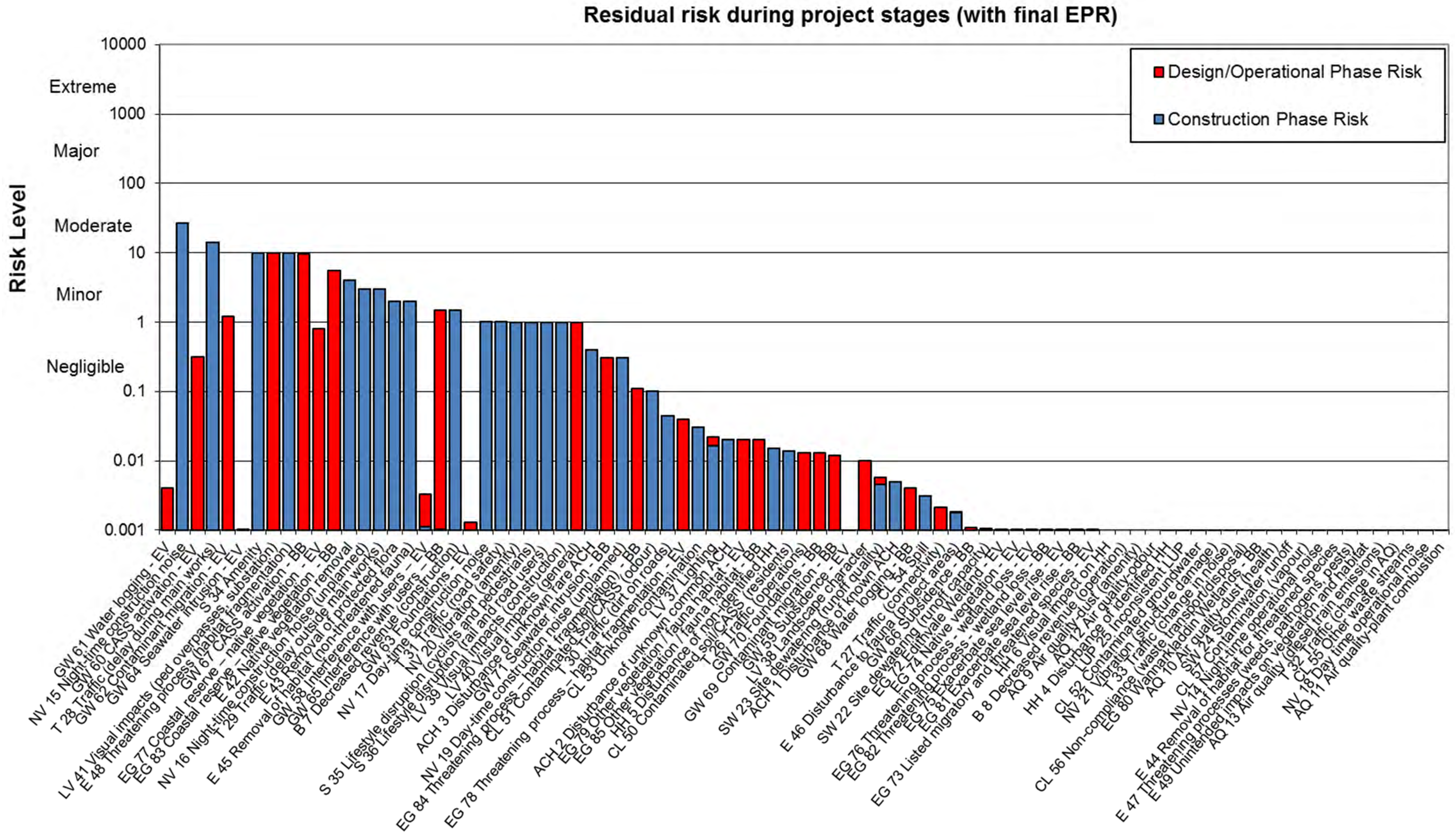
Appendix Figure 11 Initial risk to assets (lowest 42 risks)



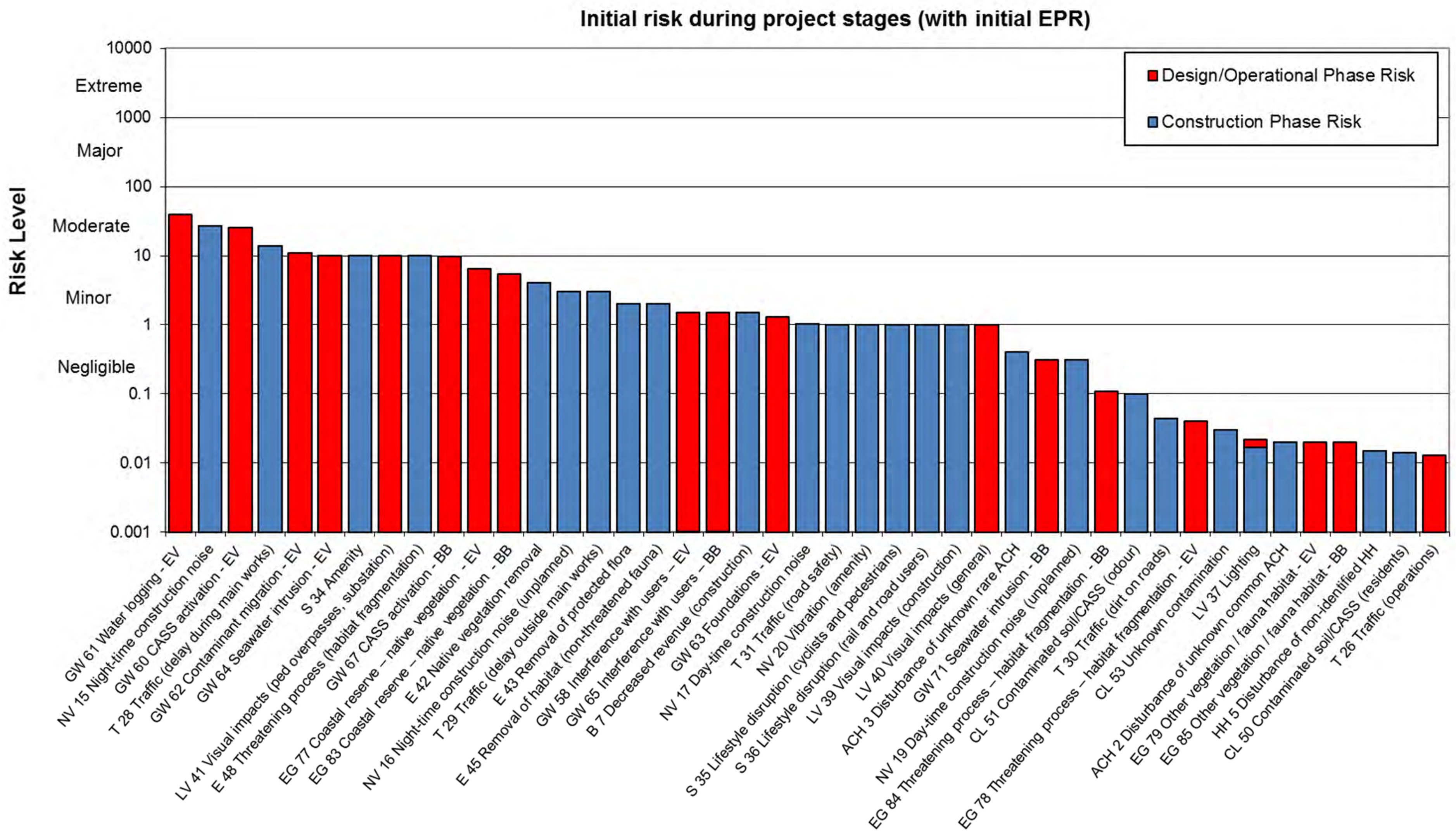
Appendix Figure 12 Residual risk to assets (lowest 42 risks)



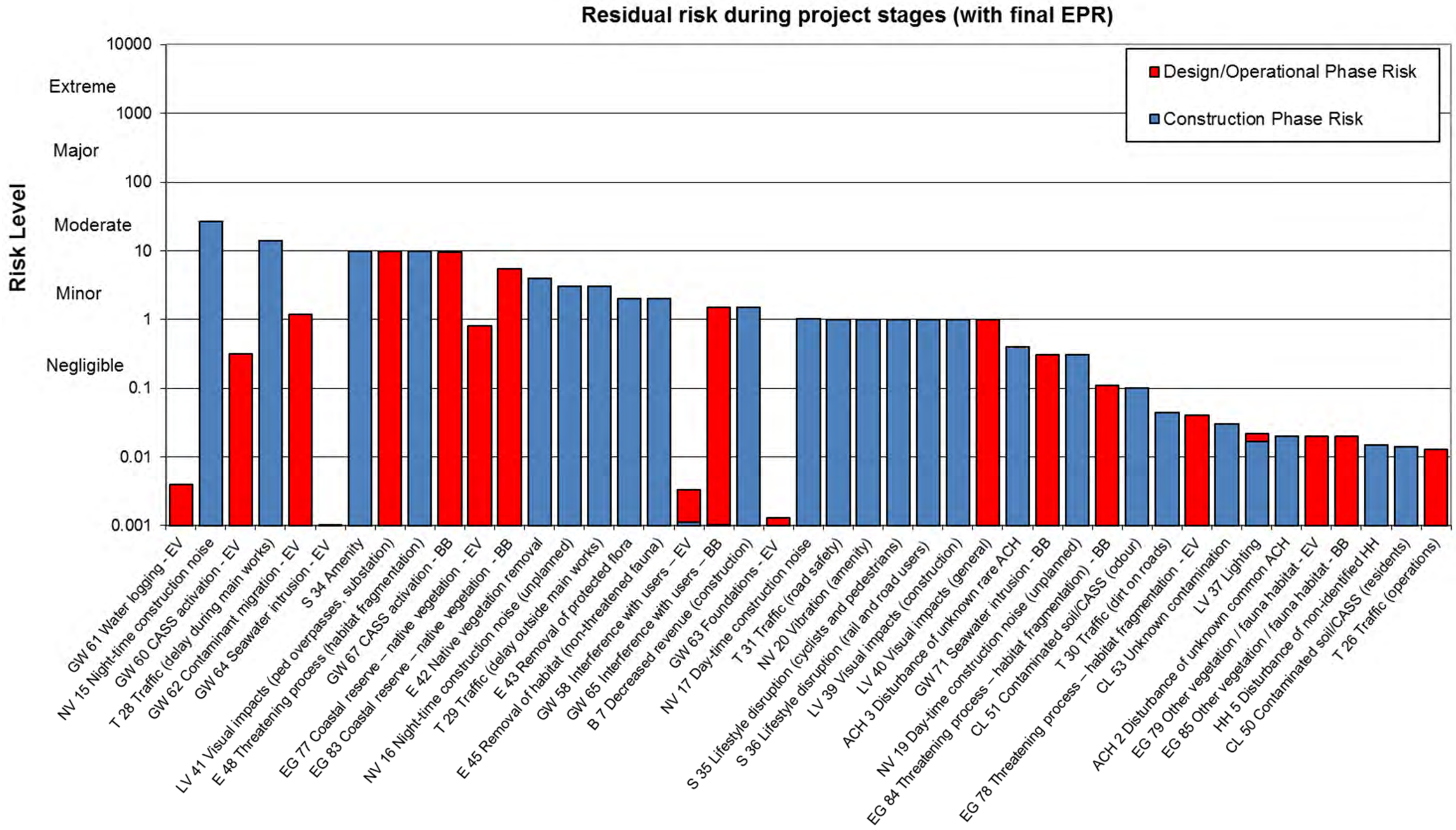
Appendix Figure 13 Initial risk to timing (all risks)



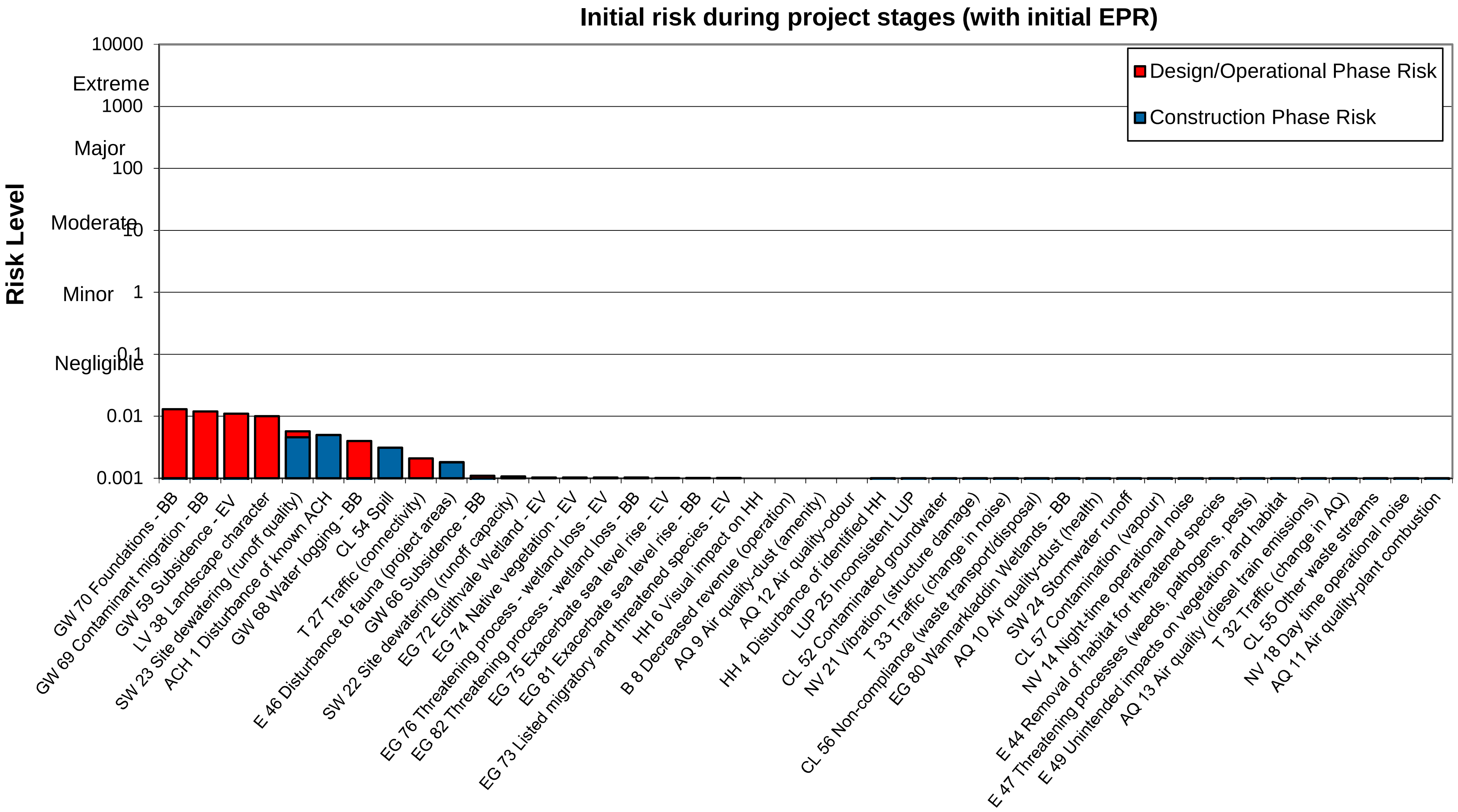
Appendix Figure 14 Residual risk to timing (all risks)



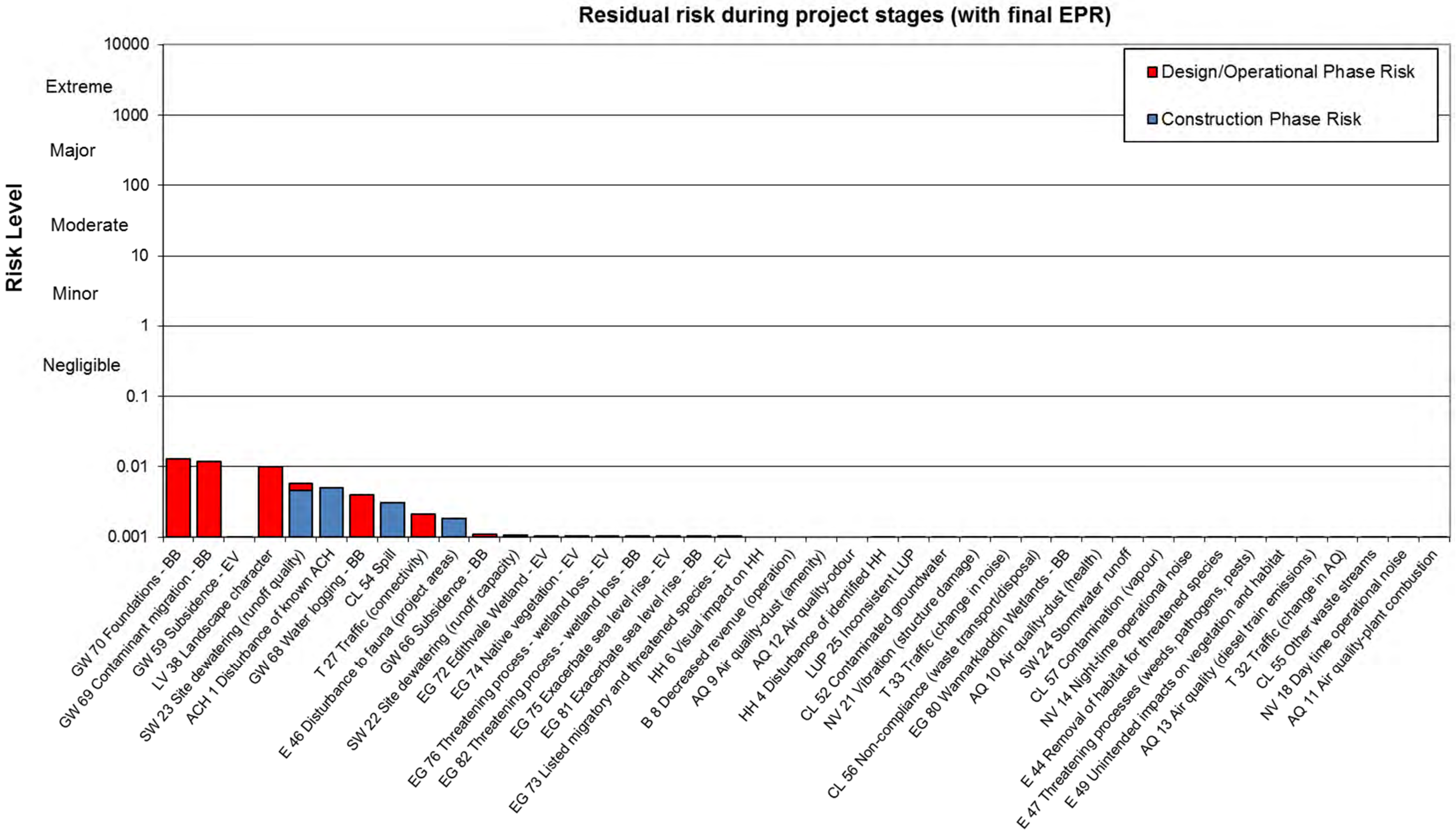
Appendix Figure 15 Initial risk to timing (highest 43 risks)



Appendix Figure 16 Residual risk to timing (highest 43 risks)



Appendix Figure 17 Initial risk to timing (lowest 42 risks)



Appendix Figure 18 Residual risk to timing (lowest 42 risks)

Appendix D – Risk model inputs

CONSTRUCTION (INITIAL)	Likelihood			Consequence					Initial risk (with initial EPR)	
Risk ID/Risk name	**Likelihood of occurrence during construction**	**Likelihood of impact**	**Total likelihood**	**Enviro**	**Social**	**Econ**	**Public H&S**	**Combined consequence level**	**Semi quantitative risk level**	**Qualitative risk level (initial)**
ACH 1 Disturbance of known ACH	0.0001	0.5	0.00005		100			100	0.005	Negligible
ACH 2 Disturbance of unknown common ACH	0.02	1	0.02		1			1	0.02	Negligible
ACH 3 Disturbance of unknown rare ACH	0.004	1	0.004		100			100	0.4	Negligible
HH 4 Disturbance of identified HH	0.00001	1	0.00001		30			30	0.0003	Negligible
HH 5 Disturbance of non-identified HH	0.01	0.5	0.005		3			3	0.015	Negligible
B 7 Decreased revenue (construction)	1	0.5	0.5			3		3	1.5	Minor
AQ 9 Air quality-dust (amenity)	0.1	0.01	0.001		1			1	0.001	Negligible
AQ 10 Air quality-dust (health)	0.01	0.001	0.00001		1		0.3	1.3	0.000013	Negligible
AQ 11 Air quality-plant combustion	0.0001	0.0001	0.00000001		1		0.3	1.3	0.000000013	Negligible
AQ 12 Air quality-odour	0.1	0.01	0.001		1			1	0.001	Negligible
NV 15 Night-time construction noise	1	0.9	0.9		30			30	27	Moderate
NV 16 Night-time construction noise (unplanned)	0.1	1	0.1		30			30	3	Minor

Risk ID/Risk name	Likelihood of occurrence during construction	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
NV 17 Day-time construction noise	1	0.1	0.1		10	0.3		10.3	1.03	Minor
NV 19 Day-time construction noise (unplanned)	0.1	0.3	0.03		10	0.3		10.3	0.309	Negligible
NV 20 Vibration (amenity)	1	1	1		1			1	1	Minor
NV 21 Vibration (structure damage)	0.0001	1	0.0001		1			1	0.0001	Negligible
SW 22 Site dewatering (runoff capacity)	0.01	0.01	0.0001	10				10	0.001	Negligible
SW 23 Site dewatering (runoff quality)	0.01	0.5	0.005	1				1	0.005	Negligible
SW 24 Stormwater runoff	0.01	0.001	0.00001	1				1	0.00001	Negligible
LUP 25 Inconsistent LUP	0.001	1	0.001		0.1			0.1	0.0001	Negligible
T 28 Traffic (delay during main works)	1	1	1		3	1	10	14	14	Moderate
T 29 Traffic (delay outside main works)	1	1	1		1	1	1	3	3	Minor
T 30 Traffic (dirt on roads)	1	0.01	0.01	1.1	0.3		3	4.4	0.044	Negligible
T 31 Traffic (road safety)	1	0.001	0.001		10		1000	1010	1.01	Minor
S 34 Amenity	1	1	1		10			10	10	Moderate
S 35 Lifestyle disruption (cyclists and pedestrians)	1	1	1		1			1	1	Minor
S 36 Lifestyle disruption (rail and road users)	1	1	1		1			1	1	Minor
LV 37 Lighting	1	0.01	0.01	1	1			2	0.02	Negligible

Risk ID/Risk name	Likelihood of occurrence during construction	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
LV 39 Visual impacts (construction)	1	0.1	0.1	1E-20	10			10	1	Minor
E 42 Native vegetation removal	1	1	1	3	1			4	4	Minor
E 43 Removal of protected flora	1	1	1	1	1			2	2	Minor
E 44 Removal of habitat for threatened species	0.01	0.0001	0.000001	3	1			4	0.000004	Negligible
E 45 Removal of habitat (non-threatened fauna)	1	1	1	1	1			2	2	Minor
E 46 Disturbance to fauna (project areas)	0.9	0.001	0.0009	1	1			2	0.0018	Negligible
E 47 Threatening processes (weeds, pathogens, pests)	0.001	0.001	0.000001	1	1			2	0.000002	Negligible
E 48 Threatening process (habitat fragmentation)	1	0.9	0.9	10	1			11	9.9	Minor
E 49 Unintended impacts on vegetation and habitat	0.001	0.001	0.000001	0.1	1			1.1	0.0000011	Negligible
CL 50 Contaminated soil/CASS (residents)	1	0.001	0.001	3	10		1	14	0.014	Negligible
CL 51 Contaminated soil/CASS (odour)	1	0.1	0.1		1			1	0.1	Negligible
CL 52 Contaminated groundwater	1	0.0001	0.0001	1			0.1	1.1	0.00011	Negligible
CL 53 Unknown contamination	0.1	0.01	0.001	30				30	0.03	Negligible
CL 54 Spill	0.001	0.1	0.0001	30	1		0.1	31.1	0.00311	Negligible

Risk ID/Risk name	Likelihood of occurrence during construction	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
CL 55 Other waste streams	0.1	0.00001	0.000001	0.1	0.1			0.2	0.0000002	Negligible
CL 56 Non-compliance (waste transport/disposal)	0.0001	1	0.0001	1				1	0.0001	Negligible
CL 57 Contamination (vapour)	0.01	0.001	0.00001				1	1	0.00001	Negligible
GW 58 Interference with users – EV	1	0.0001	0.0001	3				3	0.0003	Negligible
GW 65 Interference with users – BB	1	0.0001	0.0001	3				3	0.0003	Negligible

OPERATION (INITIAL)	Likelihood			Consequence					Initial risk (with initial EPR)	
Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
HH 6 Visual impact on HH	0.001	1	0.001		1			1	0.001	Negligible
B 8 Decreased revenue (operation)	0.01	1	0.01			0.1		0.1	0.001	Negligible
AQ 13 Air quality (diesel train emissions)	0.00001	1	0.00001	0.1				0.1	0.000001	Negligible
NV 14 Night-time operational noise	0.000001	1	0.000001		10			10	0.000001	Negligible
NV 18 Day time operational noise	0.000001	1	0.000001		0.1			0.1	0.0000001	Negligible
NV 20 Vibration (amenity)	0.0001	1	0.0001		1			1	0.0001	Negligible
SW 22 Site dewatering (runoff capacity)	0.7	0.00001	0.000007	10				10	0.00007	Negligible
SW 23 Site dewatering (runoff quality)	0.7	0.001	0.0007	1				1	0.0007	Negligible
LUP 25 Inconsistent LUP	0.001	1	0.001		0.1			0.1	0.0001	Negligible
T 26 Traffic (operations)	0.0001	1	0.0001		100	0.1	30	130.1	0.01301	Negligible
T 27 Traffic (connectivity)	0.0001	1	0.0001		10	1	10	21	0.0021	Negligible
T 32 Traffic (change in AQ)	0.00001	1	0.00001		0.1			0.1	0.000001	Negligible
T 33 Traffic (change in noise)	1	0.001	0.001		0.1			0.1	0.0001	Negligible
LV 37 Lighting	1	0.001	0.001	1	1			2	0.002	Negligible

Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
LV 38 Landscape character	1	0.01	0.01		1			1	0.01	Negligible
LV 40 Visual impacts (general)	1	1	1		1			1	1	Minor
LV 41 Visual impacts (ped overpasses, substation)	1	1	1		10			10	10	Moderate
E 46 Disturbance to fauna (project areas)	0.01	0.001	0.00001	1	1			2	0.00002	Negligible
E 48 Threatening process (habitat fragmentation)	0.0001	0.01	0.000001	30	1			31	0.000031	Negligible
GW 58 Interference with users – EV	1	0.5	0.5	3				3	1.5	Minor
GW 59 Subsidence - EV	1	0.001	0.001		10	1		11	0.011	Negligible
GW 60 CASS activation - EV	1	0.8	0.8	30	1		1	32	25.6	Moderate
GW 61 Water logging - EV	1	1	1		30	10		40	40	Moderate
GW 62 Contaminant migration - EV	1	0.9	0.9	10	1		1	12	10.8	Moderate
GW 63 Foundations - EV	1	0.01	0.01		100	30		130	1.3	Minor
GW 64 Saltwater intrusion - EV	1	0.1	0.1	100	1			101	10.1	Moderate
GW 65 Interference with users – BB	1	0.5	0.5	3				3	1.5	Minor
GW 66 Subsidence - BB	1	0.0001	0.0001		10	1		11	0.0011	Negligible

Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
GW 67 CASS activation - BB	1	0.8	0.8	10	1		1	12	9.6	Minor
GW 68 Water logging - BB	1	0.0001	0.0001		30	10		40	0.004	Negligible
GW 69 Contaminant migration - BB	1	0.001	0.001	10	1		1	12	0.012	Negligible
GW 70 Foundations - BB	1	0.0001	0.0001		100	30		130	0.013	Negligible
GW 71 Saltwater intrusion - BB	1	0.01	0.01	30	1			31	0.31	Negligible
EG 72 Edithvale Wetland - EV	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 73 Listed migratory and threatened species - EV	0.0001	0.01	0.000001	1000	1			1001	0.001001	Negligible
EG 74 Native vegetation - EV	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 75 Exacerbate sea level rise - EV	0.0001	0.01	0.000001	1000	10			1010	0.00101	Negligible
EG 76 Threatening process - wetland loss - EV	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 77 Coastal reserve – native vegetation - EV	1	0.5	0.5	3	10			13	6.5	Minor
EG 78 Threatening process – habitat fragmentation - EV	1	0.01	0.01	3	1			4	0.04	Negligible
EG 79 Other vegetation / fauna habitat - EV	1	0.01	0.01	1	1			2	0.02	Negligible

Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (initial)
EG 80 Wannarkladdin Wetlands - BB	0.0001	0.01	0.000001	30	30			60	0.00006	Negligible
EG 81 Exacerbate sea level rise - BB	0.0001	0.01	0.000001	1000	10			1010	0.00101	Negligible
EG 82 Threatening process - wetland loss - BB	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 83 Coastal reserve – native vegetation - BB	1	0.5	0.5	1	10			11	5.5	Minor
EG 84 Threatening process – habitat fragmentation - BB	1	0.01	0.01	10	1			11	0.11	Negligible
EG 85 Other vegetation / fauna habitat - BB	1	0.01	0.01	1	1			2	0.02	Negligible

CONSTRUCTION (RESIDUAL)	Likelihood			Consequence						Residual risk (with final EPR)
Risk ID/Risk name	**Likelihood of occurrence during construction**	**Likelihood of impact**	**Total likelihood**	**Enviro**	**Social**	**Econ**	**Public H&S**	**Combined consequence level**	**Semi quantitative risk level**	**Qualitative risk level (residual)**
ACH 1 Disturbance of known ACH	0.0001	0.5	0.00005		100			100	0.005	Negligible
ACH 2 Disturbance of unknown common ACH	0.02	1	0.02		1			1	0.02	Negligible
ACH 3 Disturbance of unknown rare ACH	0.004	1	0.004		100			100	0.4	Negligible
HH 4 Disturbance of identified HH	0.00001	1	0.00001		30			30	0.0003	Negligible
HH 5 Disturbance of non-identified HH	0.01	0.5	0.005		3			3	0.015	Negligible
B 7 Decreased revenue (construction)	1	0.5	0.5			3		3	1.5	Minor
AQ 9 Air quality-dust (amenity)	0.1	0.01	0.001		1			1	0.001	Negligible
AQ 10 Air quality-dust (health)	0.01	0.001	0.00001		1		0.3	1.3	0.000013	Negligible
AQ 11 Air quality-plant combustion	0.0001	0.0001	0.00000001		1		0.3	1.3	0.000000013	Negligible
AQ 12 Air quality-odour	0.1	0.01	0.001		1			1	0.001	Negligible
NV 15 Night-time construction noise	1	0.9	0.9		30			30	27	Moderate
NV 16 Night-time construction noise (unplanned)	0.1	1	0.1		30			30	3	Minor
NV 17 Day-time construction noise	1	0.1	0.1		10	0.3		10.3	1.03	Minor

Risk ID/Risk name	Likelihood of occurrence during construction	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (residual)
NV 19 Day-time construction noise (unplanned)	0.1	0.3	0.03		10	0.3		10.3	0.309	Negligible
NV 20 Vibration (amenity)	1	1	1		1			1	1	Minor
NV 21 Vibration (structure damage)	0.0001	1	0.0001		1			1	0.0001	Negligible
SW 22 Site dewatering (runoff capacity)	0.01	0.01	0.0001	10				10	0.001	Negligible
SW 23 Site dewatering (runoff quality)	0.01	0.5	0.005	1				1	0.005	Negligible
SW 24 Stormwater runoff	0.01	0.001	0.00001	1				1	0.00001	Negligible
LUP 25 Inconsistent LUP	0.001	1	0.001		0.1			0.1	0.0001	Negligible
T 28 Traffic (delay during main works)	1	1	1		3	1	10	14	14	Moderate
T 29 Traffic (delay outside main works)	1	1	1		1	1	1	3	3	Minor
T 30 Traffic (dirt on roads)	1	0.01	0.01	1.1	0.3		3	4.4	0.044	Negligible
T 31 Traffic (road safety)	1	0.001	0.001		10		1000	1010	1.01	Minor
S 34 Amenity	1	1	1		10			10	10	Moderate
S 35 Lifestyle disruption (cyclists and pedestrians)	1	1	1		1			1	1	Minor
S 36 Lifestyle disruption (rail and road users)	1	1	1		1			1	1	Minor

Risk ID/Risk name	Likelihood of occurrence during construction	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (residual)
LV 37 Lighting	1	0.01	0.01	1	1			2	0.02	Negligible
LV 39 Visual impacts (construction)	1	0.1	0.1		10			10	1	Minor
E 42 Native vegetation removal	1	1	1	3	1			4	4	Minor
E 43 Removal of protected flora	1	1	1	1	1			2	2	Minor
E 44 Removal of habitat for threatened species	0.01	0.0001	0.000001	3	1			4	0.000004	Negligible
E 45 Removal of habitat (non-threatened fauna)	1	1	1	1	1			2	2	Minor
E 46 Disturbance to fauna (project areas)	0.9	0.001	0.0009	1	1			2	0.0018	Negligible
E 47 Threatening processes (weeds, pathogens, pests)	0.001	0.001	0.000001	1	1			2	0.000002	Negligible
E 48 Threatening process (habitat fragmentation)	1	0.9	0.9	10	1			11	9.9	Minor
E 49 Unintended impacts on vegetation and habitat	0.001	0.001	0.000001	0.1	1			1.1	0.0000011	Negligible
CL 50 Contaminated soil/CASS (residents)	1	0.001	0.001	3	10		1	14	0.014	Negligible
CL 51 Contaminated soil/CASS (odour)	1	0.1	0.1		1			1	0.1	Negligible
CL 52 Contaminated groundwater	1	0.0001	0.0001	1			0.1	1.1	0.00011	Negligible

Risk ID/Risk name	Likelihood of occurrence during construction	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (residual)
CL 53 Unknown contamination	0.1	0.01	0.001	30				30	0.03	Negligible
CL 54 Spill	0.001	0.1	0.0001	30	1		0.1	31.1	0.00311	Negligible
CL 55 Other waste streams	0.1	0.00001	0.000001	0.1	0.1			0.2	0.0000002	Negligible
CL 56 Non-compliance (waste transport/disposal)	0.0001	1	0.0001	1				1	0.0001	Negligible
CL 57 Contamination (vapour)	0.01	0.001	0.00001				1	1	0.00001	Negligible
GW 58 Interference with users – EV	1	0.0001	0.0001	3				3	0.0003	Negligible
GW 65 Interference with users – BB	1	0.0001	0.0001	3				3	0.0003	Negligible

OPERATION (RESIDUAL)	Likelihood			Consequence					Residual risk (with final EPR)	
Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (residual)
HH 6 Visual impact on HH	0.001	1	0.001		1			1	0.001	Negligible
B 8 Decreased revenue (operation)	0.01	1	0.01			0.1		0.1	0.001	Negligible
AQ 13 Air quality (diesel train emissions)	0.00001	1	0.00001	0.1				0.1	0.000001	Negligible
NV 14 Night-time operational noise	0.000001	1	0.000001		10			10	0.000001	Negligible
NV 18 Day time operational noise	0.000001	1	0.000001		0.1			0.1	0.0000001	Negligible
NV 20 Vibration (amenity)	0.0001	1	0.0001		1			1	0.0001	Negligible
SW 22 Site dewatering (runoff capacity)	0.7	0.00001	0.000007	10				10	0.00007	Negligible
SW 23 Site dewatering (runoff quality)	0.7	0.001	0.0007	1				1	0.0007	Negligible
LUP 25 Inconsistent LUP	0.001	1	0.001		0.1			0.1	0.0001	Negligible
T 26 Traffic (operations)	0.0001	1	0.0001		100	0.1	30	130.1	0.01301	Negligible
T 27 Traffic (connectivity)	0.0001	1	0.0001		10	1	10	21	0.0021	Negligible
T 32 Traffic (change in AQ)	0.00001	1	0.00001		0.1			0.1	0.000001	Negligible
T 33 Traffic (change in noise)	1	0.001	0.001		0.1			0.1	0.0001	Negligible
LV 37 Lighting	1	0.001	0.001	1	1			2	0.002	Negligible
LV 38 Landscape character	1	0.01	0.01		1			1	0.01	Negligible
LV 40 Visual impacts (general)	1	1	1		1			1	1	Minor
LV 41 Visual impacts (ped	1	1	1		10			10	10	Moderate

Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (residual)
overpasses, substation)										
E 46 Disturbance to fauna (project areas)	0.01	0.001	0.00001	1	1			2	0.00002	Negligible
E 48 Threatening process (habitat fragmentation)	0.0001	0.01	0.000001	30	1			31	0.000031	Negligible
GW 58 Interference with users – EV	1	0.001	0.001	3				3	0.003	Negligible
GW 59 Subsidence - EV	1	0.00001	0.00001		10	1		11	0.00011	Negligible
GW 60 CASS activation - EV	1	0.01	0.01	30	1		1	32	0.32	Negligible
GW 61 Water logging - EV	1	0.0001	0.0001		30	10		40	0.004	Negligible
GW 62 Contaminant migration - EV	1	0.1	0.1	10	1		1	12	1.2	Minor
GW 63 Foundations - EV	1	0.00001	0.00001		100	30		130	0.0013	Negligible
GW 64 Saltwater intrusion - EV	1	0.00001	0.00001	100	1			101	0.00101	Negligible
GW 65 Interference with users – BB	1	0.5	0.5	3				3	1.5	Minor
GW 66 Subsidence - BB	1	0.0001	0.0001		10	1		11	0.0011	Negligible
GW 67 CASS activation - BB	1	0.8	0.8	10	1		1	12	9.6	Minor
GW 68 Water logging - BB	1	0.0001	0.0001		30	10		40	0.004	Negligible
GW 69 Contaminant migration - BB	1	0.001	0.001	10	1		1	12	0.012	Negligible
GW 70 Foundations - BB	1	0.0001	0.0001		100	30		130	0.013	Negligible
GW 71 Saltwater intrusion - BB	1	0.01	0.01	30	1			31	0.31	Negligible
EG 72 Edithvale Wetland - EV	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 73 Latham's Snipe - EV	0.0001	0.01	0.000001	1000	1			1001	0.001001	Negligible

Event name	Likelihood of occurrence during operation	Likelihood of impact	Total likelihood	Enviro	Social	Econ	Public H&S	Combined consequence level	Semi quantitative risk level	Qualitative risk level (residual)
EG 74 Native vegetation - EV	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 75 Exacerbate sea level rise - EV	0.0001	0.01	0.000001	1000	10			1010	0.00101	Negligible
EG 76 Threatening process - wetland loss - EV	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 77 Coastal reserve – native vegetation - EV	1	0.2	0.2	1	3			4	0.8	Negligible
EG 78 Threatening process – habitat fragmentation - EV	1	0.01	0.01	3	1			4	0.04	Negligible
EG 79 Other vegetation / fauna habitat - EV	1	0.01	0.01	1	1			2	0.02	Negligible
EG 80 Wannarkladdin Wetlands - BB	0.0001	0.01	0.000001	30	30			60	0.00006	Negligible
EG 81 Exacerbate sea level rise - BB	0.0001	0.01	0.000001	1000	10			1010	0.00101	Negligible
EG 82 Threatening process - wetland loss - BB	0.0001	0.01	0.000001	1000	30			1030	0.00103	Negligible
EG 83 Coastal reserve – native vegetation - BB	1	0.5	0.5	1	10			11	5.5	Minor
EG 84 Threatening process – habitat fragmentation) - BB	1	0.01	0.01	10	1			11	0.11	Negligible
EG 85 Other vegetation / fauna habitat - BB	1	0.01	0.01	1	1			2	0.02	Negligible

ATTACHMENT III: MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

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1 INTRODUCTION

1.1 Purpose of this attachment

This attachment to the Environment Effects Statement (EES) presents the findings of the investigations and impact assessments undertaken into Matters of National Environmental Significance (MNES) for the Edithvale and Bonbeach level crossing removal projects (the projects).

It should be read in conjunction with the context and methods presented in Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* (Sections 6.1 to 6.3) and Chapter 8 *Potential local impacts at Edithvale and Bonbeach* (Section 8.11).

The groundwater modelling described in Chapter 5 *Modelling the water environment* concluded that changes to the hydrological regime or ecological conditions due to the projects would not occur at the Edithvale-Seaford Wetlands. However, in response to Section 4.2 of the Scoping Requirements for the EES, a detailed assessment of the wetlands was undertaken and is presented in Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems.* Key outcomes are summarised in Section 2 and Section 5.1 of this attachment.

1.1.1 Matters of National Environmental Significance

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legal framework to protect and manage designated MNES. There are nine MNES protected under the EPBC Act:

- world heritage properties
- national heritage places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

Under the EPBC Act, if the Commonwealth Minister for the Environment decides that a project could potentially have a significant impact on a MNES, the project becomes a 'controlled action' that must be assessed and approved by the Minister before it can proceed. The matters which the projects may have a significant impact on are known as the controlling provisions.

The Level Crossing Removal Authority (LXRA) referred the Edithvale and Bonbeach level crossing removal projects to the Commonwealth Government under the EPBC Act. On 8 May 2017, the delegate for the Commonwealth Minister for the Environment and Energy determined that the projects are a 'controlled action' and that further assessment and approval is required under the EPBC Act before the two projects can proceed.

The decision was made due to the potential for cumulative impacts by the projects on the internationally-important Edithvale-Seaford Wetlands and the associated listed threatened and migratory flora and fauna, on the basis of the preliminary groundwater modelling. The relevant controlling provisions for this EES are:

- Ramsar wetlands (sections 16 & 17B of the EPBC Act)
- Listed threatened species and communities (sections 18 & 18A of the EPBC Act)
- Listed migratory species (sections 20 & 20A of the EPBC Act).

Ramsar wetlands

A Ramsar wetland is a wetland that has been designated under Article 2 of the Ramsar Convention, or which has been declared by the Federal Environment Minister to be a Ramsar wetland under the EPBC Act.

The Ramsar Convention encourages the designation of sites containing representative, rare or unique wetlands, or wetlands that are important for conserving biological diversity. Once designated, these sites are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites.

In designating a wetland as a Ramsar site, countries agree to establish and oversee a management framework aimed at conserving the wetland and ensuring its wise use. Wise use under the Convention is broadly defined as maintaining the ecological character of a wetland.

Listed threatened species and communities

The EPBC Act provides for the listing of nationally threatened native species and ecological communities, native migratory species and marine species. Threatened species refers to those species that are considered 'threatened, including species that are listed as 'vulnerable', 'endangered' or 'critically endangered' under the EPBC Act.

The EPBC Act protects Australia's native species and ecological communities by providing for:

- identification and listing of species and ecological communities as threatened
- development of conservation advice and recovery plans for listed species and ecological communities
- development of a register of critical habitat
- recognition of key threatening processes
- where appropriate, reducing the impacts of these processes through threat abatement plans.

Listed migratory species

Migratory species are those animals that migrate to Australia and its external territories, or pass though or over Australian waters during their annual migrations. The EPBC Act lists 37 migratory shorebirds that regularly visit Australia. These are species that are subject to the following international agreements relating to migratory shorebird conservation to which Australia is a signatory:

- Bilateral agreements:
  - Japan-Australian Migratory Bird Agreement (JAMBA)
  - China-Australia Migratory Bird Agreement (CAMBA)
  - Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
- Convention on Conservation of Migratory Species of Wild Animals (also known as the CMS or the Bonn Convention)

1.1.2 Responding to the controlled action

In response to the controlled action decision under the EPBC Act, this attachment has been prepared to summarise the findings of the EES assessment with respect to the three controlling provisions discussed above (Ramsar wetlands, listed threatened species and listed migratory species).

In order to provide necessary commentary on the likelihood of significant impacts specific to MNES identified in the determination for the projects under the EPBC Act, this attachment provides an assessment of the potential mechanisms through which impact on those MNES as a result of the projects could be realised. Potential mechanisms of impact on MNES considered in this assessment include:

- groundwater change
- noise and vibration
- acid sulfate soils and contamination (including waste production)
- dust and air quality
- surface water change
- light spill.

An assessment of the presence of MNES in the project and study areas to inform the environmental impact assessment for the works was undertaken for each controlling provision:

- Ramsar Wetlands (Section 2)
- Migratory species (Section 3)
- Threatened species (Section 4).

Section 2 (Ramsar Wetlands) also includes a detailed assessment of Edithvale Wetland in response to Section 4.2 of the Scoping Requirements.

A risk and impact assessment was undertaken for each of the three controlling provisions in accordance with the methodology described in Chapter 4 *Assessment Framework* and is included in Section 5 of this attachment. The risk and impact assessment has been split into two sections:

- **Ramsar Wetland** (Section 5.1) – addresses the potential risks and impacts resulting from the projects at Edithvale Wetland.
- **Threatened and migratory species** (Section 5.2) – addresses the potential risks and impact resulting from the projects on threatened and migratory species.

1.2 Project overview

LXRA proposes to remove two level crossings at Edithvale and Bonbeach.

At Edithvale, LXRA proposes to remove the level crossing by lowering the Frankston railway line into a trench under Edithvale Road while maintaining Edithvale Road at the current road level. The trench would be located between Lochiel Avenue and Berry Avenue. It would be up to 1,300 metres in length and 14 metres wide at its narrowest point, widening to 24 metres (including pile widths) at the new Edithvale station platforms.

At Bonbeach, LXRA proposes to remove the level crossing by lowering the Frankston railway line into a trench under Bondi Road while maintaining Bondi Road at the current road level. The trench would be located between Golden Avenue and The Glade. It would be up to 1,200 metres in length and 14 metres wide at its narrowest point, widening to 24 metres (including pile widths) at the new Bonbeach station platforms.

The areas where the level crossings would be removed are referred to as the 'project area'. Refer to Figure 1.1 (Edithvale) and Figure 1.2 (Bonbeach) for the project areas.

Figure 1.1 Edithvale project area

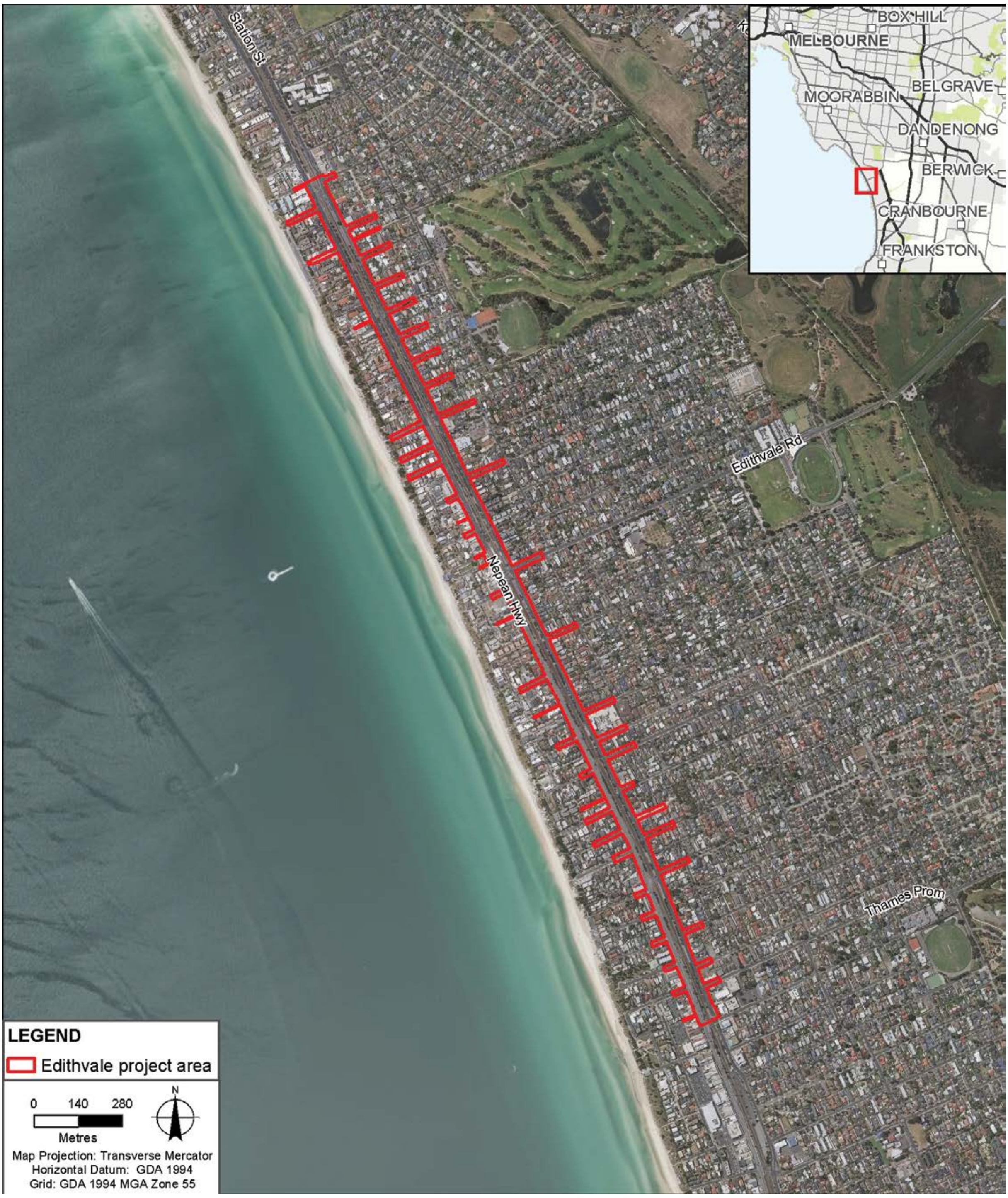
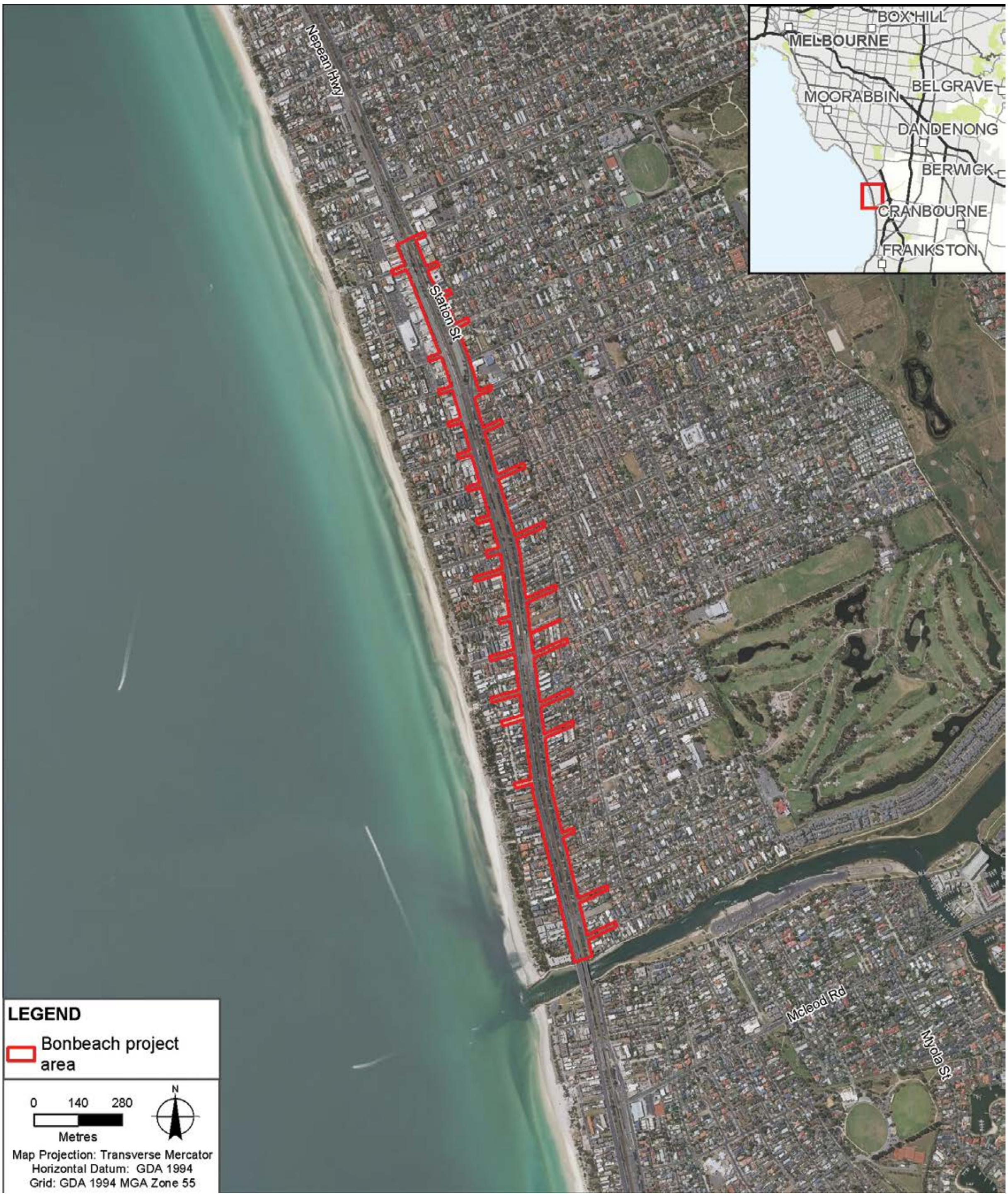
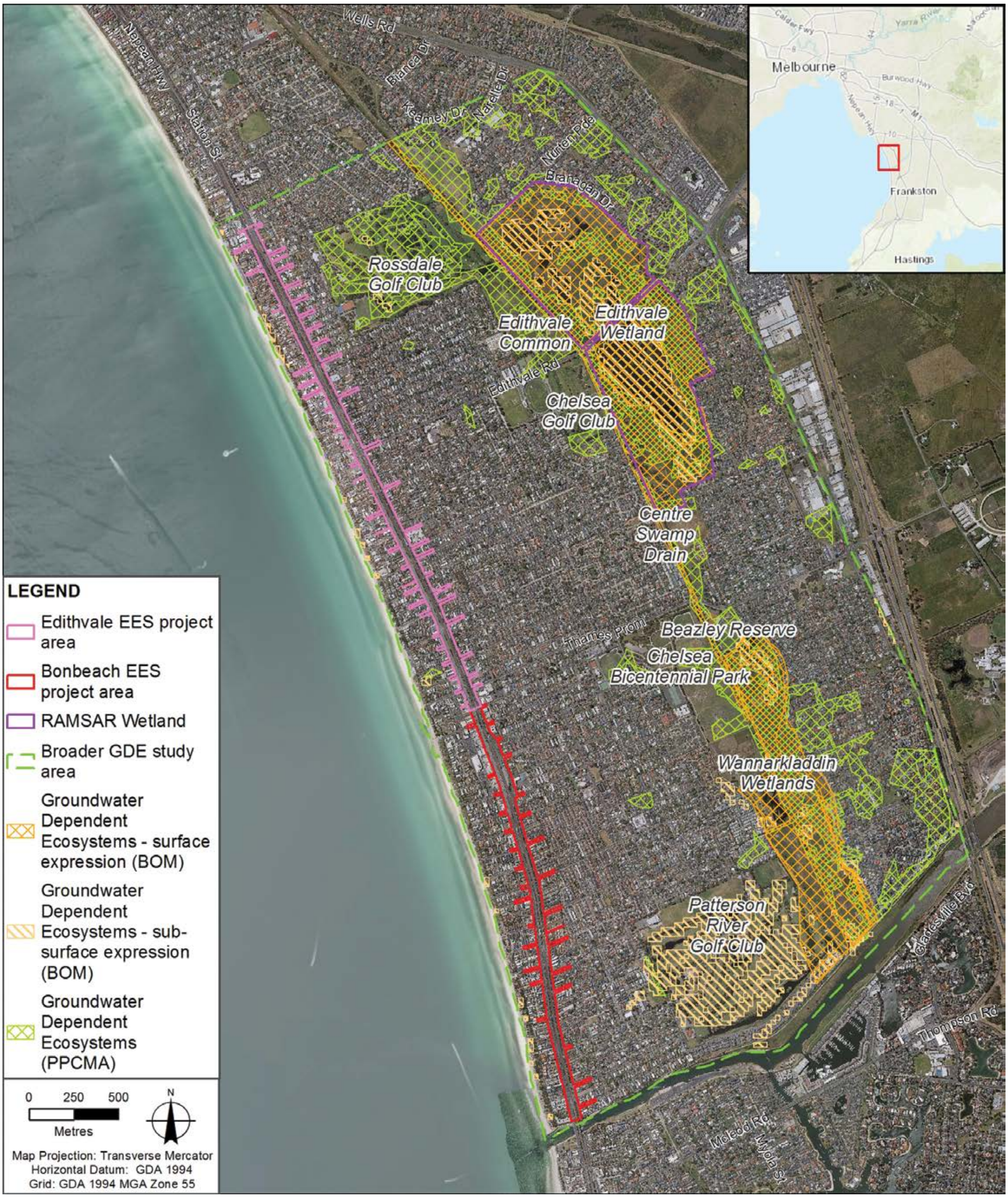


Figure 1.2 Bonbeach project area



The study area for the MNES assessment was defined on the basis of the potential extent of groundwater mounding/drawdown that was identified by the preliminary groundwater modelling (refer to Chapter 5 *Modelling the water environment)*. The GDE study area extends from the coast to approximately 2.5 kilometres inland from the Edithvale and Bonbeach project areas. Refer to Figure 1.3 below. This area includes the Ramsar listed Edithvale Wetland and locally significant Wannarkladdin Wetland.

Figure 1.3 Part A: GDE study area



Wannarkladdin Wetlands are ecologically similar to Edithvale Wetland, although not of international significance and not a Ramsar listed wetland. The Wannarkladdin Wetlands provide habitat for a number of waterbirds and shorebirds and are part of a nationally significant complex of wetlands (which includes the Edithvale-Seaford Wetlands). Based on analysis of BirdLife Australia data, Wannarkladdin Wetlands is known to provide habitat for 10 threatened and/or migratory birds. Refer to Chapter 6 *Edithvale-Seaford Wetlands and groundwater dependent ecosystems* for further information. Wannarkladdin Wetlands have only been considered in this attachment in the context of providing habitat for threatened and migratory species.

Figure 1.3 Part B: GDE study area

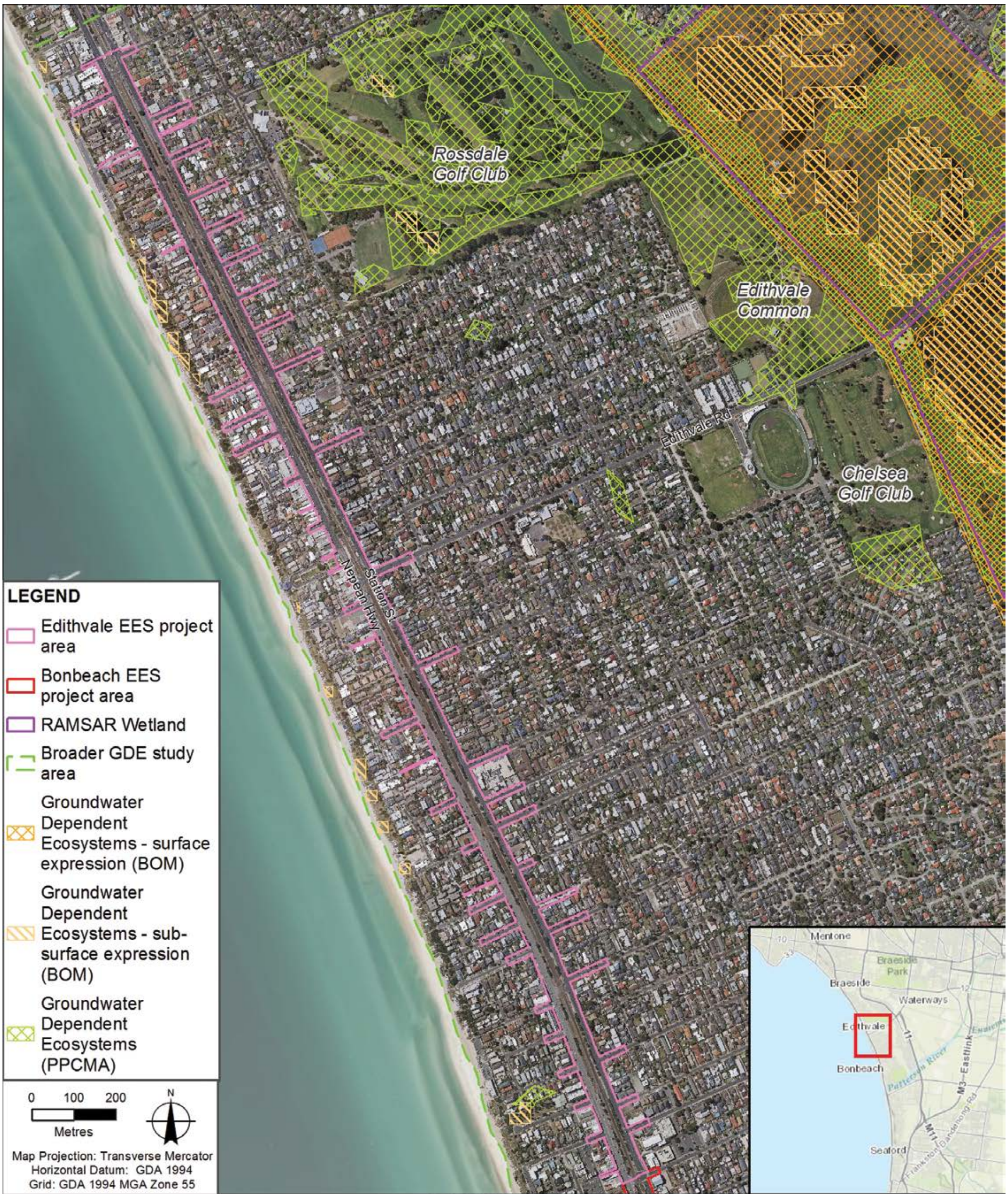
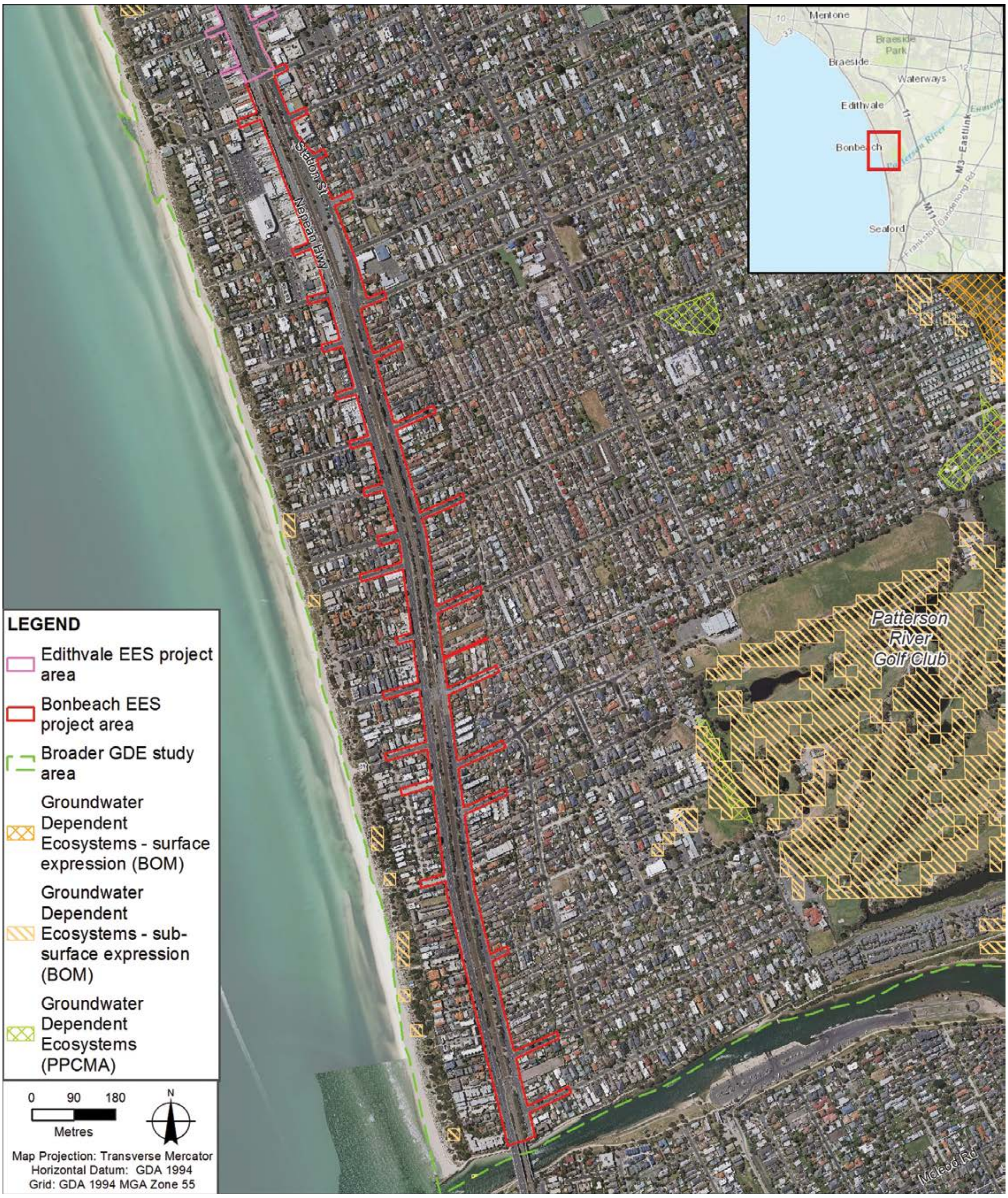

Rossdale Golf Club
Edithvale Common
Edithvale Rd
Chelsea Golf Club
Nepean Hwy
Station St
LEGEND
Edithvale EES project area
Bonbeach EES project area
RAMSAR Wetland
Broader GDE study area
Groundwater Dependent Ecosystems - surface expression (BOM)
Groundwater Dependent Ecosystems - sub-surface expression (BOM)
Groundwater Dependent Ecosystems (PPCMA)
0 100 200
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55
Mentone
Braeside Park
Braeside
Waterways
Edithvale
Bonbeach
Patterson River
M3 - Eastlink
Seaford
Frankston Dandenong Rd
M11

Figure 1.3 Part C: GDE study area


Station St
Nepean Hwy
Patterson River Golf Club
McLeod Rd
Mentone
Braeside Park
Braeside
Waterways
Edithvale
Bonbeach
Seaford
Patterson River
M3 - Eastlink
M11
Frankston-Dandenong Rd
10
33
12
11
LEGEND
Edithvale EES project area
Bonbeach EES project area
Broader GDE study area
Groundwater Dependent Ecosystems - surface expression (BOM)
Groundwater Dependent Ecosystems - sub-surface expression (BOM)
Groundwater Dependent Ecosystems (PPCMA)
0 90 180
Metres
N
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

1.3 Assessment overview

An assessment was undertaken to understand the potential for the presence of MNES in the project and study areas to inform the environmental impact assessment for the works. This assessment incorporated:

- a desktop assessment and synthesis of government-curated biodiversity datasets including the Protected Matters Search Tool (PMST)
- flora and fauna field assessments
- targeted surveys where appropriate.

Desktop assessment

The desktop assessment to determine the likelihood of MNES presence, included the following species:

- listed as threatened under the EPBC Act
- listed as migratory under the EPBC Act.

This assessment was completed for species predicted to occur by the PMST, within five kilometres of the project areas, which encompassed the study area.

Field assessments

Field assessments for MNES were undertaken in September 2016 and in July 2017 at Edithvale Wetland, and in June and August 2017 in the remainder of the study area.

The field assessments incorporated the following:

- Habitat assessments to inform the determination of the likelihood of each site to support threatened flora and fauna species. Habitat requirements were compared to existing conditions of the study area and a precautionary approach taken to their likelihood of occurrence.
- Threatened ecological community assessments.

Targeted surveys

No suitable habitat for any significant flora or fauna species was identified within the project area, and consequently no species were considered to have greater than a low likelihood of occurrence. No targeted surveys for any flora or fauna species listed under the EPBC-Act were undertaken within the project area.

Within the GDE study area seven threatened species and 20 migratory species were identified as having a moderate or above likelihood of presence (noting some species are both threatened and migratory). Flora and fauna investigations and management plans as previously completed by BirdLife Australia, Ecology Australia and Sinclair Knight Merz were reviewed to inform an assessment of species likelihood and status in the study area.

Targeted surveys for migratory and threatened birds were not undertaken for the purposes of preparing the EES. The level of survey effort by BirdLife Australia (surveys providing 30 years of records) gives a detailed and invaluable insight into the historical presence and regularity of occurrence of threatened and or migratory species within the high value GDEs of the study area. This provides highly credible information for considering the presence and use of habitat by these birds and for identifying important habitat for migratory shorebirds. The BirdLife surveys are considered to be in keeping with national survey guidelines.

Targeted surveys were undertaken where suitable data had not already been gathered. On this basis, a targeted survey was undertaken for Dwarf Galaxias at Edithvale Wetland and Patterson River, as the species was originally considered as having a likelihood of occurrence. Dwarf Galaxias surveys were carried out with reference to state and national survey guidelines for the species. No individuals were found during surveys and the likelihood was revised to unlikely. In addition habitat assessments were completed for Grey-headed Flying-fox commensurate with national survey guidelines. These assessments informed the assessment of species likelihood. Incidental records of significant flora were undertaken as part of the vegetation assessment.

All other threatened and migratory species were assumed to be present where appropriate habitat was also present within the study area.

2 RAMSAR WETLANDS

There are no Ramsar wetlands in the project area. There is one Ramsar wetland in the study area – the Edithvale-Seaford Wetlands Ramsar Site. The Edithvale and Seaford wetlands site are two discrete wetland systems which are physically distinct and are separated by the Patterson River (refer to Technical Report A *Groundwater*).

The Seaford Wetland is not connected by ground or surface water with the Edithvale and Bonbeach level crossing removals projects and therefore would not be impacted by them. The focus of the EES is on the Edithvale Wetland section of the Edithvale-Seaford Wetlands (referred to here as the 'Edithvale Wetland').

A detailed assessment of Edithvale Wetland was undertaken in response to Section 4.2 of the Scoping Requirements and is presented in Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*. The assessment is summarised in the following section, in conjunction with an assessment of the MNES at Edithvale Wetland.

The Edithvale Wetland covers 103 hectares and provides 39 hectares of wetland habitat. The wetland is a combination of both natural and excavated ponds (referred to as wetland cells) to the north and south of Edithvale Road. Edithvale Wetland is owned and managed by Melbourne Water.

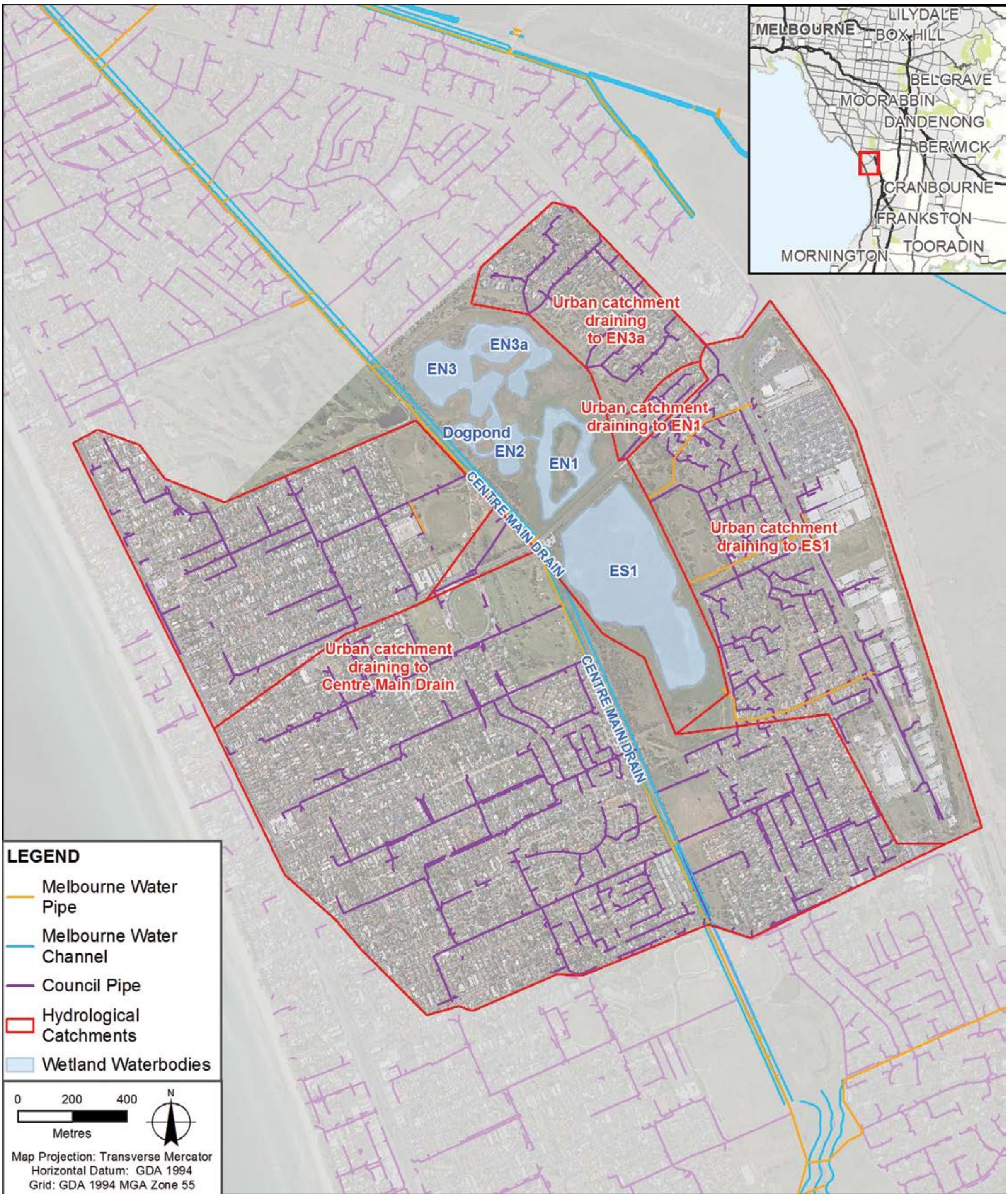
The ability to provide suitable habitat for protected and migratory species is partially due to the seasonal nature of the wetlands themselves. During summer, many of the cells dry out, some to the extent of being reduced to small shallow pools. During summer, mudflats are exposed due to the 'drying' of the wetland, providing habitat favoured by waterbirds, and particularly, migratory shorebirds. This 'wetting and drying' cycle is a key process contributing to the wetlands' international importance.

2.1 Overview of wetland cells

Edithvale Wetland contains a complex of diverse wetland types, including shallow freshwater marshes, permanent open freshwater wetlands and brackish to saline ponds. These consist of a number of water bodies of varying sizes and depths.

Many of the cells are interconnected, controlling the movement of the water from the eastern cells (where surface water inflows are received) to the western cells that discharge to the Centre Main Drain. Edithvale Wetland is divided into two regions – north and south – each comprising a number of individual cells. The complex is separated by Edithvale Road (refer to Figure 1.4).

Figure 1.4 Edithvale Wetland cells



2.1.1 Northern wetland cells

The northern portion of Edithvale Wetland encompasses the following cells (refer to Figure 1.4):

- Edithvale North 1 (EN1)
- Edithvale North 2 (EN2)
- Edithvale North 3 (EN3)
- Edithvale North 3a (EN3a)
- Edithvale North – Dog Pond.

Each cell is described below in Table 1.1. The majority of these cells have varying salinity levels, attributed to the interaction with groundwater. The cells maintain a mixture of permanent and seasonal water bodies, fringed mainly by tall reed beds such as Tall Marsh. Threatened or migratory species that have been recorded at these sites include the Australasian Bittern, Latham's Snipe, Baillion's Crake, Blue-billed Duck, Freckled Duck, Hardhead, Musk Duck, Magpie Goose, Australasian Shoveler and Great Egret.

Table 1.1 Northern wetland cells

Wetland cell and description	Photo
Edithvale North 1 (EN1) Edithvale North 1 (EN1) is a large cell located in the south of the northern section of the Edithvale Wetland. EN1 is a shallow, peat-lined cell, supporting the growth of Salt Club-sedge in late summer and autumn extensive and dense beds of Tall Marsh. The presence of water fluctuates. During summer, the water in the cell evaporates and the vegetation surrounding EN1 dries out. In wet months, the cell maintains moist areas due to the interaction with groundwater.	
Edithvale North 2 (EN2) Edithvale North 2 (EN2) is a deep cell that permanently maintains water throughout the year. The cell interacts with groundwater and the water is saline. The open waters of the cell are fringed by Tall Marsh.	

Wetland cell and description	Photo
Edithvale North 3 (EN3) Edithvale North 3 (EN3) is similar to EN2 – a large expanse of permanent open water, fringed with Tall Marsh. The water is fresh to brackish. EN3 is the largest permanent waterbody of the north portion of the wetlands.	
Edithvale North 3a (EN3a) Edithvale North 3a (EN3a) contains fresh water. EN3a is a deep pool that experiences wetting and drying dependent on the relationship between surface water inflows and evaporation. Filling of this cell generally only occurs between July and August, with inflows mainly contributed from stormwater. This cell exhibits a range of vegetation communities and is one of the smaller cells in the wetlands.	
Edithvale North – Dog Pond The dog pond is a small but deep pool, accessible to the public via a shared user path from Edithvale Common. It is segregated from the main wetland area by fencing and is designated for dogs to swim and play in to reduce disturbance of wildlife elsewhere within the Edithvale Wetland. Water level is determined by groundwater and also relies on inflows from cell EN2.	

2.1.2 Southern wetland cells

The southern portion of Edithvale Wetlands is considered to be one cell – Edithvale South 1 (ES1). ES1 encompasses a few deeper sections which are referred to as Edithvale South 1a (ES1a) and Edithvale South 1b (ES1b). Refer to Figure 1.4, above, for the location of the cells.

The southern wetland cell is of greater ecological importance than the northern cells for migratory bird species that feed on exposed or near exposed mudflats. ES1 is described below in Table 1.2.

Table 1.2 Southern wetland cells

Wetland cell and description	Photo
Edithvale South 1 (ES1) ES1 is a natural dish-shaped pond, approximately 0.5 metres deep and underlain by a thick peat layer which thins towards the edges. The cell comprises sections of shallow and deeper fresh-brackish marsh. During summer and autumn, water levels of ES1 recede, exposing large areas of mudflats critical for the foraging habitat of migratory birds. Two deeper sections (ES1a and ES1b) retain water for longer during dry periods. The southern portion of Edithvale Wetlands exhibit complex vegetation including tall and shorter reed beds of Tall Marsh, Brackish Wetland and Salt Club-sedge.	

2.1.3 Relationship to the wider water environment

The Edithvale Wetland functions as an essential component of the regional drainage system, serving as an important flood storage component. The water in the wetlands is largely sourced from drains collecting stormwater runoff from developed catchments to the north and east. The stormwater primarily enters via litter traps and sediment ponds at wetland cell EN3. Water is discharged via the Centre Main Drain (to the west) to Mordialloc Creek which then flows into Port Phillip Bay. Alternative sources of inflows at Edithvale Wetland include overland flows and groundwater discharge.

Between 1987 and 1988, some of the wetland cells at Edithvale Wetland were excavated, which penetrated the underlying clay layer. This resulted in a permanent connection between shallow groundwater and surface water within these cells, altering the natural hydrology and surface water quality by increasing levels of salinity.

Many of the wetland cells are interconnected, creating a complex network of water flows. Wetland cell ES1 is relatively shallow, and drains into the northern wetland component via a pipe beneath Edithvale Road. The wetland cells in the northern component drain to the north – EN1 flows into EN2, which flows into EN3. Refer to Chapter 5 *Modelling the water environment* for further details, including a map showing how water flows in the wetland cells.

2.2 Vegetation

Native vegetation includes patches of native vegetation and scattered native trees. The removal of native vegetation is controlled through the application of *Guidelines for the removal, destruction or lopping of native vegetation* an incorporated document under the *Planning and Environment Act 1987.*

Seven EVCs were recorded during EVC mapping of Edithvale Wetland conducted in July 2017:

- Swamp Scrub (EVC 53)
- Tall Marsh (EVC 821)
- Brackish Wetland Aggregate (EVC 656)
- Brackish Aquatic Herbland (EVC 537)
- Aquatic Herbland (EVC 653)
- Plains Grassy Woodland (EVC 55)
- Coast Banksia Woodland (EVC 2).

These EVCs are described in Table 1.3.

Ecological Vegetation Class (EVC)

In Victoria, patches of native vegetation are classified by an Ecological Vegetation Class (EVC) which are based on the general ecological characteristics and underlying geology of the vegetation.

Table 1.3 Native vegetation at Edithvale Wetland

EVC and description	Picture
Swamp Scrub (EVC 53) EVC 53 occurs as small, fragmented patches elevated on three small islands in the north of Edithvale Wetlands (EN1). This EVC is characterised by Swamp Paperbark with a degraded understorey which includes Blackberry and exotic grasses. Scattered Swamp Gums are occasionally present in the patches EVC 53 has a Biodiversity Conservation Status (BCS) of endangered in the Gippsland Plain Bioregion.	
Tall Marsh (EVC 821) EVC 821 is dominated by thick swards of Common Reed and occasionally Cumbungi. Old growth Common Reed is tall and dense while regrowth of Common Reed has a less dense, more open structure. Tall Marsh forms a buffer around the wetlands that shields birds from some human disturbance. This function is actively maintained near walking paths and around the boundary, particularly along Edithvale Road.	

EVC and description	Picture
Brackish Wetland Aggregate (EVC 656) This EVC appears as unvegetated open water/bare soil/mud (EVC 990) for approximately 6 months of the year and large areas have been displaced by the encroachment of Common Reed. EVC 656 has a BCS of endangered in the Gippsland Plain Bioregion.	
Brackish Aquatic Herbland (EVC 537) EVC 537 occurs in deeper water and is dominated by aquatic herbs and fibrous algae. EVC 537 has contracted in extent over the past decade from being once abundant in both northern and southern Edithvale Wetlands to now only in the constructed wetlands in the north.	
Aquatic Herbland (EVC 653) EVC 653 occurs in an area of southern wetland cell ES1 and is replaced with Tall Marsh and Brackish Wetland Aggregate/Unvegetated (open water/ bare soil/mud) as the water levels recede in spring and summer.	
Plains Grassy Woodland (EVC 55) EVC 55 is represented by patches of planted native trees and shrubs including River Red-gum, Swamp Gum and Banksia over a weedy understorey. The understorey of these patches appears regularly mown as part of the maintenance at the wetland.	

EVC and description	Picture
Coast Banksia Woodland (EVC 2) EVC 2 was recorded during field work from elevated land between some wetland cells, and was identifiable by the dominance of Coast Banksia yet to reach canopy height, and growing above introduced grass species. It is considered probable that these patches of vegetation have been planted.	

An additional three EVCs have been previously recorded within Edithvale Wetland by Ecology Australia, however they were not recorded during the July 2017 EVC mapping. These are described below:

- Damp Sands Herb-rich Woodland (EVC3) – was generally restricted to the outer extent of the Edithvale Wetland property boundary, forming an almost continuous link around the cells in the northern portion of the wetlands. A number of these patches are considered likely to have been revegetated. EVC3 has a Bioregional Conservation Status (BCS) of vulnerable in the Gippsland Plain Bioregion.
- Plains Sedgy Wetland (EVC 647) – occurs in the lower lying areas of wetland cell EN1 and is dominated by Water Ribbons, Water-milfoil, Streaked Arrow-grass and Tall Spike-sedge. The floristic diversity of this vegetation is threatened by the encroachment of Common Reed and Cumbungi, which surround and are interspersed through all patches.
- Brackish Herbland (EVC 538) – previously occurred on the outskirts of the Edithvale South and in the middle of the wetland. The distribution of this EVC is likely to fluctuate each year in response to season and rainfall.

2.2.1 Threatened plants

The current management plan for the Ramsar site considers that there is suitable habitat present within Edithvale Wetland for River Swamp Wallaby-grass and Swamp Everlasting (listed under the EPBC Act), Pale Swamp Everlasting (vulnerable in Victoria) and Lacey River Buttercup (rare in Victoria).

Although many of the wetland cells provide the seasonally fluctuating surface water levels that encourage areas of bare ground that River Swamp Wallaby-grass prefers, the prevalence of Tall Marsh EVC around and within many of the cells has reduced the extent of available habitat for River Swamp Wallaby-grass. The growth of both indigenous and exotic graminoid (herbaceous, grass-like) plants is the biggest limiting factor for the existence of the species at the wetland.

The prevalence of aquatic, semi-aquatic and terrestrial weed species at the site is also considered to be a significant limiting factor to the existence and/or persistence of Swamp Everlasting, Pale Swamp Everlasting and Lacey River Buttercup at Edithvale Wetland. However, in the absence of targeted surveys for these species, the likelihood assessments as provided in the current management plan for the site have been adopted for this assessment.

2.3 Fauna

The Edithvale Wetland supports a dynamic and diverse number of animals, many of which are threatened and/or migratory bird species. This diversity is attributed to the complex and cyclical nature of the wetlands habitat. Threatened and migratory species are discussed later in this chapter.

183 bird species have been recorded at Edithvale Wetland, many of which are reliant on the unique aquatic environment. The importance of the wetlands for other birds is perhaps best demonstrated by the diversity of birds of prey it supports. Species recorded include the Swamp Harrier and Little Eagle which are birds not often sighted in suburban Melbourne. The wetland also supports a number of common waterbirds and small woodland bird species.

Twenty-nine native mammal species have been recorded within Edithvale Wetland. These include Eastern Bent-wing Bat, Eastern Grey Kangaroo, Swamp Wallaby and the Short-beaked Echidna. Introduced animals recorded include cats, dogs, Red Fox and Brown Hares.

While no specific reptile surveys are known to have been undertaken within Edithvale Wetland, a number of reptiles have been recorded including the Eastern Blue-tongue Lizard, Southern Grass Skink and Eastern Brown Snake. Ten species of frogs have been recorded within the wetlands including the common Eastern Banjo Frog and the Southern Brown Tree Frog. Potential habitat has been identified for Growling Grass Frog, Southern Toadlet, Verreaux's Tree Frog and Haswell's Frog, however these have not been recorded.

Fish surveys completed as part of this EES investigation recorded four species in the northern wetland cells – Flathead Gudgeon (the only native species recorded), Mosquito Fish, Goldfish, and Oriental Weather-loach. No species of fish were detected in the southern wetland cells. Dwarf Galaxias was previously considered to have potential to be present at the wetlands however the species was not detected during the targeted fish surveys conducted.

Zooplankton (particularly *Daphiniidae cladocerans* and *Calanoid copepods*) and *Chironominae* (midge fly) larvae were the most abundant macroinvertebrates in Edithvale Wetland. Zooplankton and benthic invertebrates were most abundant in the southern wetland. This is considered to be a reflection of the relatively uniform depth, a more pronounced wetting and drying cycle, more uniform habitat and less saline water recorded during the EES investigations.

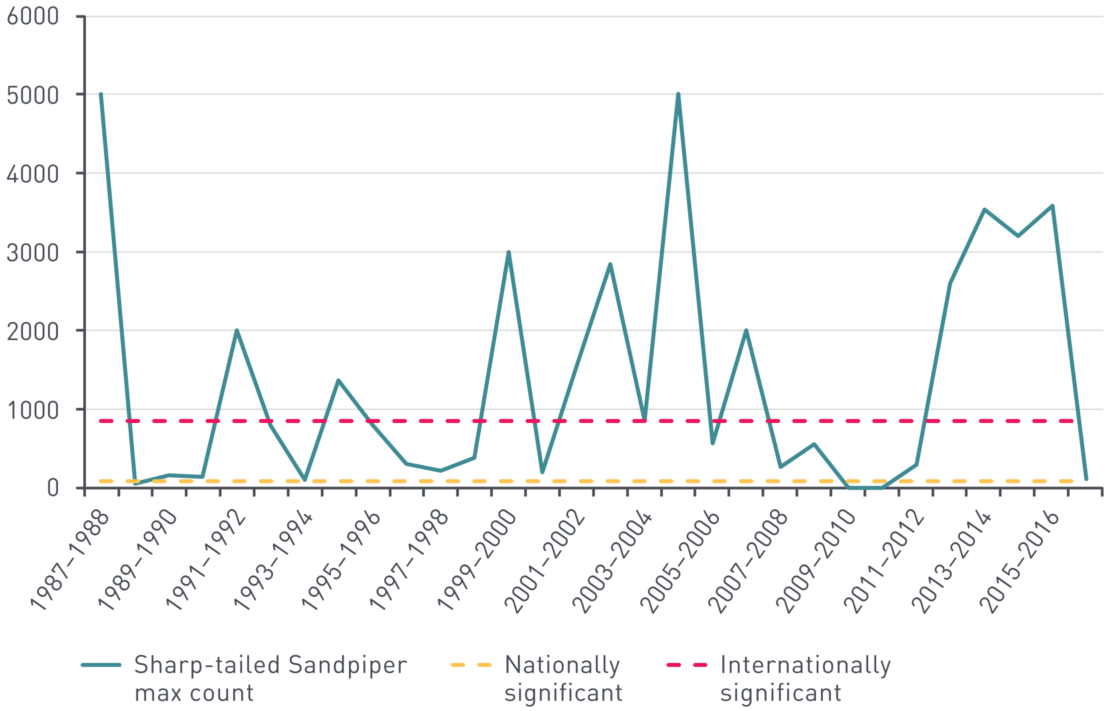
2.3.1 Migratory birds

Edithvale Wetland is known to support a diversity of migratory birds. Key species of concern in relation to the Edithvale Wetland are those which were the basis for the listing of the Edithvale-Seaford Wetlands Ramsar Site and other species which are most dependent on wetland environments. These species could be impacted by any changes to wetland environments associated with the level crossing removals.

Key migratory bird species include Sharp-tailed Sandpiper, and Latham's Snipe. Habitat is considered internationally important for migratory shorebirds if it regularly supports one per cent of the East Asian-Australasian Flyway (EAAF) population of a migratory shorebird population, and nationally important if it supports 0.1 per cent of the EAAF population.

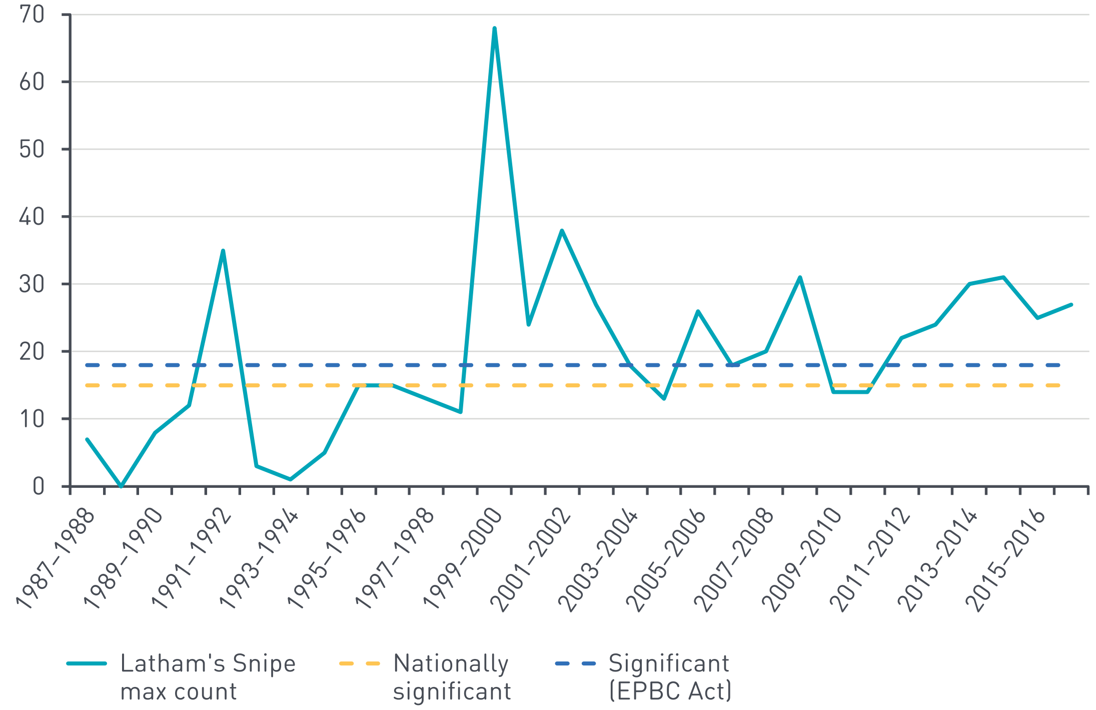
The Sharp-tailed Sandpiper is a shorebird listed as migratory under the EPBC Act. Edithvale Wetland is an internationally significant non-breeding site for the species as it regularly supports more than one per cent of the EAAF. The population recently estimated at 85,000 individuals, as shown in Figure 1.5.

Figure 1.5 Sharp-tailed Sandpiper observations, Edithvale Wetland 1987 – 2016 (max. counts by BirdLife Australia)



Latham's Snipe is a migratory shorebird listed as migratory under the EPBC Act. Edithvale Wetland represents nationally significant habitat for Latham's Snipe and significant habitat for the species under the EPBC Act as it regularly supports more than 0.05 per cent of the EAAF population, which was recently estimated at 30,000 individuals (see Figure 1.6). The threshold for nationally significant habitat is lower for Latham's Snipe due to the cryptic nature of the species.

Figure 1.6 Latham's Snipe observations, Edithvale Wetland 1987 – 2016 (max. counts by BirdLife Australia)



2.3.2 Other migratory birds

An additional 12 migratory shorebirds listed under the EPBC Act have been recorded in small numbers at the Edithvale Wetland and/or within the broader study area. These species are:

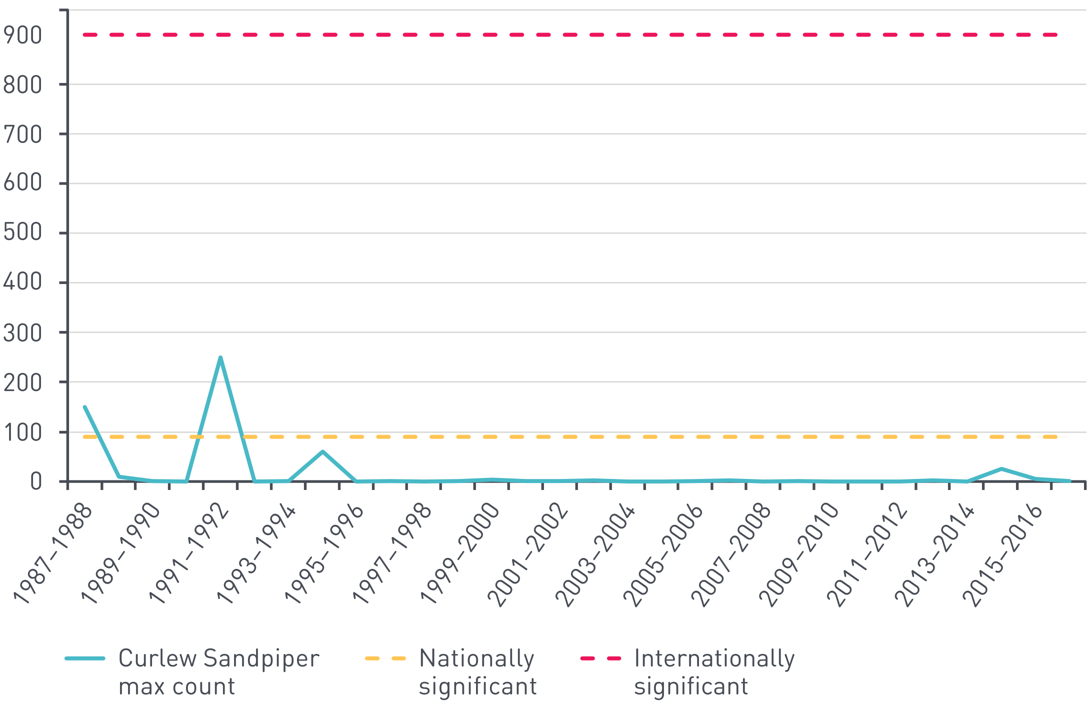
- Bar-tailed Godwit
- Common Greenshank
- Double-banded Plover
- Golden Plover
- Little Curlew
- Long-toed Stint
- Marsh Sandpiper
- Pectoral Sandpiper
- Red Knot (also listed as endangered under the EPBC Act)
- Red-necked Stint
- Wood Sandpiper.

2.3.3 Threatened fauna

The Curlew Sandpiper is a shorebird listed as critically endangered under the EPBC Act. The species is also listed as migratory under the EPBC Act and threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act). The Curlew Sandpiper is considered endangered in Victoria.

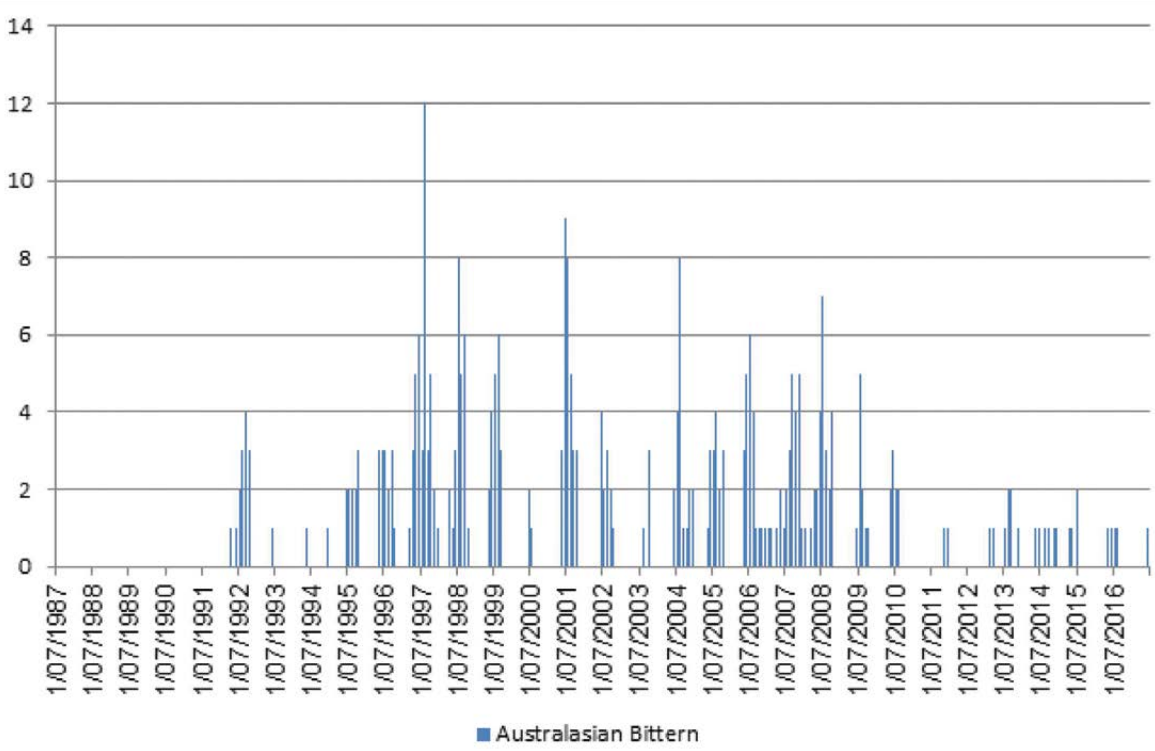
The Curlew Sandpiper has been irregularly recorded at Edithvale Wetland and, when present, the species is usually seen in low abundance (10 birds or less) which is below the threshold for the site to be considered to support nationally or internationally significant habitat for the species, as shown in Figure 1.7. Species presence at the wetland is however included in the wetlands Ramsar listing.

Figure 1.7 Curlew Sandpiper observations, Edithvale Wetland 1987 – 2016 (max. counts by BirdLife Australia)



The Australasian Bittern is a non-migratory species listed as endangered under the EPBC Act, threatened under the FFG Act and is considered endangered in Victoria. In 2010, the estimated total population of the species in Australia was 250 – 800 individuals. Australasian Bittern has been regularly recorded in small numbers within the Edithvale Wetland (maximum counts of 12 birds). Presence of the species at Edithvale Wetland is shown overtime in Figure 1.8. Australasian Bitterns presence at the wetland is included in the wetlands Ramsar listing.

Figure 1.8 **Australasian Bittern observations, Edithvale Wetland 1987 – 2016 (max. counts by BirdLife Australia)**



2.3.4 Other threatened birds

An additional 15 bird species threatened in Victoria have been recorded in the Edithvale Wetlands, as listed in Table 1.4. One species, Australian Painted Snipe, is also listed as threatened under the EPBC Act.

Some species are regularly observed in high numbers. The birds recorded in the highest numbers all belong to the family Anatidae (Ducks, Geese, and Swans). These species utilise the wetlands differently to migratory birds, with most species preferentially using the deeper northern wetland cells.

Table 1.4 Other threatened birds at Edithvale Wetland

Common Name	EPBC Act	FFG Act	Status in Victoria
Australasian Shoveler			Vulnerable
Australian Little Bittern		Listed	Endangered
Australian Painted Snipe	Vulnerable	Listed	Critically endangered
Ballion's Crake		Listed	Vulnerable
Blue-billed Duck		Listed	Endangered
Caspian Tern		Listed	Near threatened
Eastern Great Egret		Listed	Vulnerable
Freckled Duck		Listed	Endangered
Hardhead			Vulnerable
Intermediate Egret		Listed	Endangered
Lewin's Rail		Listed	Vulnerable
Little Egret		Listed	Endangered
Magpie Goose		Listed	Near threatened
Musk Duck			Vulnerable
White Bellied Sea-Eagle		Listed	Vulnerable

2.4 Significance and listings

Important habitat for migratory shorebirds is defined by criteria outlined in the *Wildlife Conservation Plan for Migratory Shorebirds 2015* and the *Ramsar Convention on Wetlands of International Importance.* The EPBC Act is triggered when proposed actions are likely to have a significant impact on important habitat for migratory shorebirds.

2.4.1 Wildlife Conservation Plan for Migratory Shorebirds

The *Wildlife Conservation Plan for Migratory Shorebirds 2015* defines the terms of nationally and internationally important habitat based on the approach applied through the criteria adopted under the Ramsar Convention.

Wetland habitat is considered internationally important if it regularly supports:

- one per cent of the individuals in a population of one species or subspecies of waterbird or
- a total abundance of at least 20,000 birds.

Wetland habitat is considered of national importance if it regularly supports:

- 0.1 per cent of the flyway population of a single species of migratory shorebird (with the exception of Latham's Snipe, see below) or
- 2000 migratory shorebirds or
- 15 migratory shorebird species.

2.4.2 East Asian-Australian Flyway (EAAF)

Australia is one of 23 countries listed in the EAAF which spans from Alaska, United States of America in the north to New Zealand in the south. A flyway is a term used to describe the migratory pathway of a group of migratory shorebirds. This range includes breeding, stop-off (rest) and over-wintering locations. The EAAF is one of nine major flyways recognised internationally and the only one that involves visitation to Australia.

Australia is part of the Partnership for the Conservation of Migratory Waterbirds and the Sustainable Use of their Habitats in the EAAF (the EAAF Partnership). The Partnership has established a network of internationally important sites for migratory shorebirds.

Of the 397 sites recognised to be internationally important for shorebird conservation in the EAAF, 188 occur in Australia. The Australian sites are comprised of 35 southward migration sites, 94 non breeding sites, 20 north migration sites and 17 breeding sites. The Edithvale-Seaford Wetland is one such internationally important site (non-breeding).

2.4.3 Ramsar Criteria

The Edithvale-Seaford Wetlands are considered to meet Ramsar site Criteria 2, 4 and 6. This is based on the most recent assessment of the wetlands as completed by Hale and Butcher (2017). This assessment '*Ecological Character Description Addendum Edithvale-Seaford Wetlands*' (the Addendum) was prepared in 2017 by DELWP.

The Ramsar criterion met by the Edithvale-Seaford Wetlands and the justification for their application as described in the Addendum are outlined in Table 1.5 below.

Table 1.5 Ramsar Criteria

Ramsar Listing Criteria	Justification for Ramsar Criteria
Criterion 2 *A wetland should be considered internationally important if it supports vulnerable, endangered or critically endangered species or threatened ecological communities.*	This criterion is only applied to wetland dependent flora and fauna, and the site regularly supports two fauna species listed under the EPBC Act and/or International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: • Australasian Bittern – Endangered (EPBC Act and IUCN). Foraging and breeding habitat are provided by the wetlands. It is one of 20 birds funded as a priority by the Australian Government to support the species recovery effort. The species has been recorded since 1989 when surveys began. • Curlew Sandpiper – Critically Endangered (EPBC Act). This species was not listed as threatened under the EPBC Act at the time of the Edithvale-Seaford Wetlands being listed as a Ramsar site.
Criterion 4 *A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their lifecycles or provides refuge during adverse conditions.*	The basic description of this criterion implies a number of common functions and roles that wetlands provide including supporting fauna during migration, providing drought refuge, supporting breeding and moulting in waterfowl. Twenty species of waterbirds listed under international migratory agreements have been recorded within the Edithvale –Seaford Wetlands. This number includes species that, in Australia, are residents (e.g. eastern great egret) and a number of migratory species that are occasionally recorded at the site. There are eight species of international migratory shorebirds that are regularly supported by the Edithvale-Seaford Wetlands.
Criterion 6 *A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.*	Ramsar Convention guidance indicates that assessment of this criterion should be made using the most recent official population estimates (Wetlands International 2012). Data provided by BirdLife Australia indicate that two species meet this criterion: • Sharp-tailed sandpiper– average annual maximum abundance (1994 – 2015) = 1870 (slightly above the 1 % of population estimate of 1600) • Australasian bittern– average annual maximum abundance (1994 – 2015) = 5 (equivalent to the 1 % of population estimate).

Ecosystem components, processes and services (CPS)

The *National framework and guidance for describing the ecological character of Australian Ramsar wetlands 2008* prepared by the Department of Environment, Water, Heritage and Arts (DEWHA) describes critical components, processes and services (CPS) that make up the ecological character of wetlands.

The Addendum applied the criteria in the framework and identified four CPS that are critical to the ecological character of the Edithvale-Seaford Ramsar site:

- **Threatened wetland species** – two threatened bird species occur regularly in low numbers (Australasian Bittern and Curlew Sandpiper). This CPS is also related to listing of the site under Ramsar criteria 2.
- **Physical habitat for waterbirds** – the mosaic nature of the habitat (open water, emergent native vegetation and exposed mudflats) supports a diversity of species.
- **Waterbird breeding** – 20 species of wetland dependent birds have been recorded breeding within the Ramsar site. This CPS is also related to listing of the site under Ramsar criteria 4.
- **Waterbird diversity and abundance** – the Ramsar site supports a diversity and abundance of waterbirds. This CPS is also related to listing of the site under Ramsar criteria 6.

The critical CPS which relate to Ramsar listing criteria are also covered in the description of those criteria in Table 1.5 above. The Scoping Requirements stipulate that the EES assess adverse impacts on the four CPS that are critical to the ecological character of the wetlands at the time of listing.

Physical habitat for waterbirds is not directly related to a Ramsar listing criteria. The variety of the habitat is what supports the diversity of species. The most important habitat zones being:

- **Edithvale North** – deeper water for a number of duck species which is surrounded by tall reeds
- **Edithvale South** – shallow wetland that provides foraging habitat for shorebirds, grading to tall marsh at the fringes
- **Seaford North 2 Pool, Seaford Central West 1 and Seaford Central East 2** – mosaic of deeper water, tall marsh, and deeper saline ponds important for all wetland bird species.

Protection under the EPBC Act

Ramsar wetlands are recognised as a Matter of National Environmental Significance under the EPBC Act and, as such, any action that has, will have, or is likely to have a significant impact on the ecological character of a Ramsar Wetland must be referred to the Minister and be subject to an environmental assessment and approval process.

The *Matters of National Environmental Significance – Significant Impact Guidelines 2013* provide criteria to define what constitutes a significant impact on wetlands of international importance (Ramsar sites). In accordance with the guidelines an action will be deemed to have the potential for a significant impact if it will result in:

- Areas of the wetland being destroyed or substantially modified
- A substantial or measureable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration, and frequency of ground and surface water flows to and within the wetland
- The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected
- A substantial and measurable change in the water quality of the wetland- for example a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity, or human health, or
- An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

3 MIGRATORY SPECIES

No flora or fauna species listed as migratory under the EPBC Act were assessed as having a moderate or greater likelihood of occurrence in the project areas. Low threatened species likelihood is attributable to the heavily disturbed nature of the project areas and the intensive land use (primarily transport) in proximity to the rail corridor.

A total of 20 bird species listed as migratory under the EPBC Act are considered to have at least moderate likelihood of occurrence within the GDE study area. This determination is supported by formal bird surveys completed by Birdlife Australia (ongoing since 1987) at Edithvale Wetland and Wannarkladdin Wetlands, and data from the Victorian Biodiversity Atlas (VBA) and Protected Matters Search Tool (PMST).

Migratory species considered to make the most significant use of suitable habitats within the study area are:

- Sharp-tailed Sandpiper
- Latham's Snipe.

Other species listed as migratory under the EPBC Act that are considered to have at least a moderate likelihood of occurrence include wader species such as egrets, predominately aerial species such as Fork-tailed Swift *Apus pacificus*, and other migratory shorebird species recorded less frequently such as Common Sandpiper *Actitis hypoleucos* and Curlew Sandpiper. Curlew Sandpiper is also listed as threatened under the EPBC Act and, as such, this species is discussed under listed threatened species in Section 4.

A number of habitats for listed migratory species occur within the study area. Core habitat is provided by the Edithvale Wetland – refer to Section 2 for a detailed description. The large aggregations of migratory species that occur within this wetland are testament to its value for migratory shorebirds. Wannarkladdin Wetlands also provide habitat for migratory shorebirds. Less favourable habitat is provided by the vegetation along the northern bank of the Patterson River, anthropogenic waterbodies within golf courses and the Centre Main Drain. These areas provide low quality habitat and may be visited by migratory species on an occasional and opportunistic basis. They do not represent significant or important habitat for migratory species.

4 THREATENED SPECIES

No species listed under the EPBC Act are likely to occur in the project areas. Flora and fauna habitat present within the project areas is discussed in Section 5.2 of Technical Report D *Ecology: Project Areas*.

It is acknowledged that foraging habitat for Grey-headed Flying-fox occurs throughout suburban Melbourne and is likely to occur in neighbouring areas on an occasional and opportunistic basis however as the project areas are typically devoid of foraging trees the species is considered to have a low likelihood of occurrence.

Two flora species and five fauna species listed as threatened under the EPBC Act are considered to have at least a moderate likelihood of occurrence within the GDE study area:

- River Swamp Wallaby-grass
- Swamp Everlasting
- Australasian Bittern
- Curlew Sandpiper (also listed as migratory under the EPBC Act)
- Bar-tailed Godwit (two subspecies) (also listed as migratory under the EPBC Act)
- Australian Painted Snipe
- Grey-headed Flying-fox.

With the sole exception of Grey-headed Flying-fox no listed threatened species are considered likely to occur outside of the high value habitat provided by Edithvale Wetland and Wannarkladdin Wetlands.

4.1 River Swamp Wallaby-grass and Swamp Everlasting (Vulnerable)

River Swamp Wallaby-grass and Swamp Everlasting are both considered to have a moderate likelihood of occurrence at Edithvale Wetland and Wannarkladdin Wetlands, but are unlikely to persist within the remainder of the study area due to historical and ongoing disturbance impacting any potential remaining habitat.

Targeted surveys for these species were not completed for preparation of the EES, primarily because the project is now considered unlikely to impact either of these wetlands.

4.2 Australasian Bittern (Endangered)

Australasian Bittern is present at Edithvale Wetland and is considered to have a moderate likelihood of occurrence at Wannarkladdin Wetlands. Within the broader study area, the species has a low likelihood of occurring due to an absence of suitable habitat. While the study area beyond the high value GDEs may provide foraging habitat it is not considered critical to the local persistence of the species.

The Ramsar listing of the Edithvale Wetland recognises the significance of the presence of Australasian Bittern. An outline of the species status at Edithvale Wetland and in the remainder of the study area is provided in Appendix E of EES Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems*.

4.3 Curlew Sandpiper (Critically endangered and migratory)

Curlew Sandpiper is known to occur within Edithvale Wetland on an infrequent basis. However, the species has not been recorded in sufficient numbers to consider the wetland to be of either international or national significance for the species.

Curlew Sandpiper has not been recorded at the Wannarkladdin Wetlands, however there is suitable habitat available and the species may occur there on an occasional basis. The species is considered to have a low likelihood elsewhere in the study area.

4.4 Bar-tailed Godwit (Vulnerable and migratory)

Bar-tailed Godwit *Limosa lapponica* is a migratory shorebird that has been recorded at Edithvale Wetland by BirdLife Australia on four occasions in 1987, with a maximum of three individuals observed in one count. The species has not been recorded at Edithvale Wetland since.

More than one subspecies of Bar-tailed Godwit exists; the nominate species, *Limosa lapponica*, and two subspecies – Bar-tailed Godwit (Western Alaskan) *Limosa lapponica baueri* and Bar-tailed Godwit (Northern Siberia) *Limosa lapponica menzbieri*.

The BirdLife Australia data does not distinguish between the two subspecies, however, birds that occur in south-eastern Australia and New Zealand are thought to be subspecies baueri. Bar-tailed Godwit (Western Alaskan) is listed as vulnerable under the EPBC Act and Bar-tailed Godwit (Northern Siberia) is listed as critically endangered under the EPBC Act. Both subspecies were identified in the PMST search but for the purpose of this attachment the species is addressed as a whole rather than on a subspecies basis.

Bar-tailed Godwit is considered to have a moderate likelihood of occurrence within Wannarkladdin Wetlands and a low likelihood elsewhere in the study area. Habitat within the Edithvale Wetland is not considered to be nationally or internationally significant for Bar-tailed Godwit give the paucity of records within the wetland.

4.5 Australian Painted Snipe (Endangered)

The Australian Painted Snipe has been recorded at Edithvale Wetland and is considered present, although this determination is based on a single individual recorded on four occasions in 2008 within the BirdLife Australia data (refer to Section 1.3).

It has not been recorded since. The species has a moderate likelihood of occurrence at Wannarkladdin Wetlands and a low likelihood at other GDEs. No significant habitat for the species is considered to occur in the study area.

4.6 Grey-headed Flying-fox (Vulnerable)

Grey-headed Flying-fox have been recorded at Edithvale Wetland and are considered to have a moderate likelihood of occurrence at other GDEs. The species disperses from its camp in Yarra Bend across suburban Melbourne to forage.

Grey-headed Flying-fox is likely to forage throughout the study area on an opportunistic and occasional basis. Foraging resources include suitable vegetation within nature strips, backyards and recreation reserves such as fruit-bearing trees and flowering eucalypts. Such resources within the study area are not considered critical for the species persistence within the broader Melbourne region.

5 IMPACT ASSESSMENT

5.1 Ramsar Wetland

Construction

No risks were identified during the construction phase of the Edithvale and Bonbeach level crossing removal projects in relation to the Edithvale Wetlands and groundwater dependent ecosystems given the physical distance of over one kilometre between the level crossing sites and the wetlands. Refer to Technical Report B *Ecology: Wetlands and Groundwater Dependent Ecosystems* for further information.

Operation

The initial and residual risks identified for the operation phase of the Edithvale and Bonbeach level crossing removal projects in relation to the Edithvale Wetlands and groundwater dependent ecosystems are outlined in Table 1.6.

Table 1.6 Edithvale Wetland risks – operation

Risk ID	Risk name	Risk pathway	Initial EPR	Initial risk	Final EPR	Residual risk
EG72	Edithvale-Seaford Wetland Ramsar Site (Edithvale)	Groundwater mounding resulting in altered hydrological regime and/or water quality leading to a change in ecological character (habitat and/or food availability) that exceeds the limit of acceptable change for critical components, processes and systems to the extent that the Edithvale-Seaford Wetlands no longer meet criteria for listing as a Ramsar site.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater EPR FF8 – GDE Monitoring and mitigation plan (Edithvale Wetland)	Negligible
EG73	Listed migratory and threatened species	Groundwater mounding leading to an altered hydrological regime and resulting in change in habitat (wet grassland/ mudflats) at Edithvale Wetland to the extent that the site no longer regularly supports listed migratory and/or threatened bird species. Species include Sharp-tailed Sandpiper Latham's Snipe, Australian Bittern and Curlew Sandpiper.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 – GDE Monitoring and mitigation plan (Edithvale Wetland)	Negligible
EG74	Native vegetation (Edithvale)	Groundwater mounding resulting in altered hydrological regime and/or water quality resulting in loss of native vegetation (patches and scattered trees) within Edithvale Wetland leading to a reduction in the extent of native vegetation in Victoria.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater EPR GW3 – Groundwater Management and Monitoring Plan EPR FF8 – GDE Monitoring and mitigation plan (Edithvale Wetland)	Negligible
EG75	Exacerbate sea level rise (Edithvale)	Groundwater mounding resulting in altered hydrology exacerbates or accelerates predicted effects of sea level rise (climate change) resulting in a loss of habitat and change in ecological character of Edithvale Wetland resulting in failure to meet the LAC for critical CPS and/or Ramsar listing criteria.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater	Negligible
EG76	Threatening process – wetland loss (Edithvale)	Loss of Edithvale Wetland resulting in the exacerbation of a threatening process listed under the FFG Act.	EPR GW1 – Rail trench design	Negligible	EPR GW1 – Rail trench design EPR GW2 – Groundwater	Negligible

Edithvale Wetland provides habitat for a diversity of wildlife. This is associated with the range of habitats the wetland supports which is largely as a result of a hydrological regime and water quality that suits those habitats. Ideal hydrology for the wetlands includes inundation over winter and early spring with a slow drawdown from September to December to provide habitat for migratory waders. Maintenance of deeper pools as permanent water for waterfowl is also important.

Changes to hydrology and water quality (particularly salinity) are recognised as threats to the Edithvale-Seaford Wetland and pose a risk to the criteria under which the site was listed under the Ramsar Convention (as discussed in Section 2.4).

If groundwater mounding were to occur at the wetlands it could potentially alter the hydrological regime and/or water quality of Edithvale Wetland which could result in:

- change in habitat and/or food availability to the extent that the Edithvale-Seaford Wetlands exceed the limit of acceptable change for critical components, processes and systems and no longer meet criteria for listing as a Ramsar site
- change in habitat (wet grassland/mudflats) to the extent that the site no longer regularly supports a nationally significant population of Latham’s Snipe
- loss of native vegetation (patches and scattered trees) within Edithvale Wetland leading to a reduction in the extent of native vegetation in Victoria.
- an acceleration, or exacerbation of the predicted effects of sea level rise through climate change, leading to a change in the ecological character of Edithvale Wetland that exceeds the limits of acceptable change for critical CPS and the site no longer meets the Ramsar listing criteria
- exacerbation of a threatening process listed under the FFG Act – wetland loss.

Based on groundwater modelling predictions which are documented in Chapter 5 *Modelling the water environment*, the level crossing removal projects have a negligible risk of groundwater mounding impacting on the habitat of Edithvale Wetland.

The projects would be designed to comply with EPR_GW2 which requires that groundwater level changes do not result in significant ecological impacts on groundwater dependent ecosystems. Compliance with EPR_GW2 would ensure that the rail trench design minimises changes to groundwater levels.

Engineering design development undertaken for this EES has shown that an engineering solution can be implemented that would reduce the magnitude of predicted groundwater mounding (increase in groundwater level) from 0.1 metres within 500 metres of Edithvale Wetlands (based on the initial modelled trench design), to 0.1 metres over 1,000 metres away from Edithvale Wetlands (based on the modelled engineering solution). The residual risk of impacts to the Edithvale Wetlands is therefore negligible, as it is considered almost impossible for changes in groundwater due to the project to affect the ecological character of the Edithvale Wetland.

To confirm the prediction of the model, a Groundwater Management and Monitoring Plan (EPR reference GW3) would be developed to the satisfaction of the EPA Victoria and relevant water authorities to monitor and manage predicted and potential impacts to groundwater following construction of the piled trench walls to confirm that EPR_GW2 has been achieved.

The Groundwater Management and Monitoring Plan must include:

- detailed monitoring parameters including timing, location of monitoring bores
- duration of the monitoring program
- clear trigger levels for changes in groundwater level and quality that require mitigation plans to be implemented.

A Groundwater Dependent Ecosystem Monitoring and Mitigation Plan for Edithvale Wetland would be developed in consultation with the Department of Environment and Energy, DELWP and the land manager (EPR reference FF8). The Plan would only be implemented in the unlikely event that trigger levels for changes to groundwater level and quality detailed in the Groundwater Management and Monitoring Plan were realised.

The Groundwater Dependent Ecosystem Monitoring and Mitigation Plan must include:

- monitoring of groundwater level and water quality at representative and strategic locations
- the frequency and duration of monitoring
- monitoring of surface water quality at representative and strategic locations within the wetlands to differentiate temporal trends from long term changes to groundwater
- criteria (levels and quality) for groundwater and surface water in and around the Edithvale Wetland for determining whether a change in groundwater levels and/or quality is attributable to the projects

- response measures in the event groundwater and surface water change criteria are met, such as:
  - a process for ecological assessment developed by a suitably qualified ecologist to assess changes in aquatic fauna, birds and vegetation and consider whether these can be attributable to groundwater or surface water changes
  - criteria for determine whether a change in the extent or condition of the wetlands is attributable to the projects
  - contingency measures to mitigate potential impacts attributable to the projects
  - include the frequency and duration of monitoring.

Implementing the above controls would maintain the risk as negligible.

5.2 Threatened and migratory species

The following section addresses risks and impact assessment of threatened and migratory species that occur across the study area.

Table 1.7 Threatened and migratory species risk assessment

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk level
E44	Removal of habitat for threatened species	Removal of habitat for threatened flora and/or fauna species within the project area affecting the persistence of the species.	No EPR specified	Negligible
E46	Disturbance to fauna (project areas)	Increase in noise, vibration and artificial light affecting fauna behaviour within or adjacent to project area resulting in a decline in fauna abundance and/or diversity.	EPR AQ1 Air quality (construction) EPR AQ2 Air quality management EPR NV2 Construction noise EPR SW1 Stormwater management – construction EPR LV2 Lighting EPR LV3 Light spillage	Negligible

Risk ID	Risk name	Risk pathway	Final EPR	Residual Risk level
E49	Unintended impacts on vegetation and habitat	Unintended impacts on adjacent/retained vegetation and habitat resulting from: • Inappropriate placement of construction stockpiling resulting in unintended impacts to native vegetation and habitat. • Soil compaction or excavation causing root damage and vegetation loss within (or adjacent to) the project area. • Dust generation during construction impacting the health of vegetation. • Spills of chemicals resulting in pollution of native vegetation or habitat (particularly Edithvale Wetland and/or Wannarkladdin Wetland) either through surface or groundwater flows. • Unintended loss of vegetation to be retained from accidental plant/personnel access to designated 'No Go Areas' or areas outside of the defined and anticipated project area.	EPR FF5 Protection of retained/ adjacent vegetation	Negligible

The discussion below addresses impacts to threatened and migratory species that could occur during construction and operation.

Groundwater change and quality

No impacts are predicted as a direct result of construction activities. Detailed regional groundwater modelling (refer to Technical Appendix A *Groundwater*) indicates that groundwater mounding during the construction and operational phases of the project would not interact with any habitats considered to support MNES.

No change to groundwater level or quality is predicted to occur at Edithvale Wetland or Wannarkladdin Wetlands. The 0.1 metre groundwater mounding contour occurs no closer than 1,000 metres to the west of the Edithvale Wetland and 1,500 metres to the west of Wannarkladdin Wetlands. As these areas of habitat are not likely to be affected by groundwater change, the Edithvale and Bonbeach level crossing removal projects are not likely to have a significant impact on the Edithvale-Seaford Wetlands Ramsar Site, Wannarkladdin Wetlands, nor the threatened flora and fauna species they are known to support.

Further discussion is provided in Chapter 6 in relation to Edithvale Wetland and Chapter 8 in relation to Wannarkladdin Wetlands.

A number of EPRs have been developed that would avoid, minimise and/or mitigate potential project related impacts to GDEs and therefore MNES. Measures to avoid or minimise groundwater change are a requirement of EPR_GW2 and EPR_GW3 requires the implementation of a groundwater monitoring program to ensure project performance as it relates to the extent and degree of alteration of groundwater is met. These EPRs are presented in Chapter 9 *Environmental Management Framework*.

Change in groundwater quality as it relates to acid sulfate soils, waste production and contamination during the construction and operation stages of the projects are dealt with in EES Technical Report C *Acid Sulfate Soils and Contamination* and summarised in Chapter 7 *Acid sulfate soils and contamination*. This report considers spoil, industrial waste, the presence and activation potential of acid sulfate soils, and chemical use and storage associated with the projects.

The assessment found that spoil (including fill, contaminated soil and acidic soil) and groundwater generated by the trench excavation, during the construction phase, would be removed from the project area and transported to an appropriately licensed facility (EPR references CL1 and CL2). Therefore there is not expected to be any opportunity to indirectly impact MNES.

A Construction Environment Management Plan (EPR reference CL3) would be developed to ensure waste generated during construction is appropriately handled so that no off-site impacts occur, including to MNES.

Impacts to soil and groundwater during operation as a result of the projects are minimal and are not expected to impact on MNES. This is because impacts identified are associated with groundwater mounding and drawdown which have been modelled to occur over 1,000 metres from the identified MNES habitat.

Noise and vibration

Noise and vibration impacts of the projects are considered in EES Technical Report H *Noise and Vibration* and EPRs are provided to avoid or minimise those impacts. Noise and vibration levels sufficient to cause disturbance to amenity are not expected to extend more than 100 metres beyond the rail corridor.

No impacts to MNES are anticipated as a consequence of construction or operational noise or vibration associated with the level crossing removals. This is due to:

- the distance of the project areas from primary habitats considered to support MNES within the study area – Edithvale-Seaford Wetland (approximately 1,000 metres) and Wannarkladdin Wetlands (approximately 1,500 metres)
- the location of those habitats within a heavily urbanised area of Melbourne where there are existing sources of noise pollution. These include, but are not limited to, light and heavy vehicle traffic on the local road network with the most notable roads being Nepean Highway, Edithvale Road (which dissects the Edithvale Wetland) and the M11 (approximately 700 metres east of Edithvale Wetland and approximately 600 metres east of Wannarkladdin Wetlands).

Noise associated with construction within the level crossing removal project areas is unlikely to represent an additional or notable source of disturbance to threatened and/or migratory species utilising habitat within the study area.

Noise associated with operation following the level crossing removals was modelled as part of this project. The modelling results demonstrated that noise would not increase to an extent that it would affect MNES.

EPRs designed to further mitigate impacts include EPR_NV1 which requires the design to be in compliance with relevant policy and EPR_NV2 which requires the development of the Construction Noise and Vibration Management Plan.

Surface water

Surface water impacts of the projects are considered in the EES Technical Report E *Surface Water* which assesses the drainage network for new rail infrastructure, changes to the drainage network and flood protection. EPRs are provided to avoid or minimise the impacts identified.

Surface water risks during construction can be managed by applying standard construction environmental management techniques to protect local waterways (EPR reference SW1).

Surface water generated during operation would be collected and treated prior to discharge so that stormwater discharges do not impact beneficial uses of receiving waterbodies (EPR reference SW2).

Additionally EPRs (EPR references SW3 and SW4) require surface water discharge during construction and operation to have no adverse impact to the drainage network capacities, and maintenance of existing levels of flood protection associated with overland flow paths during construction and operation (EPR references SW5 and SW6).

As a result of these mitigation measures and the distance to the project area impacts to MNES are not anticipated.

Dust and air quality

EES Technical Report I *Air Quality* considers impacts associated with construction including dust and operational emissions. During construction, impacts related to dust impacts off-site can be controlled by applying standard construction environmental management measures.

Due to the applications of the following EPRs and the distance between the project areas and the location of MNES, there are not expected to be impacts to MNES:

- EPR_AQ1 requires construction activities to minimise dust
- EPR_AQ2 requires the control of smoke, dust, fumes and other pollution during construction and operation in accordance with the State Environment Protection Policies for Air Quality Management and Ambient Air Quality.

For operational impacts, the air modelling undertaken predicts that for all modelled pollutants, pollutant concentrations would be much lower than existing background concentrations and are therefore unlikely to have an impact on MNES.

EES Technical Report G *Traffic* considers construction traffic movements, and dirt and debris on roads in the project area and on access routes to the project area during the construction phase. Construction traffic routes would be determined prior to commencing work on-site and the following EPRs have been developed to mitigate impacts during construction:

- EPR_T1 requires the development of Transport Management Plan to mitigate the impacts of traffic generated by construction activities, including the development of route options that recognise sensitive receptors
- EPR_T7 includes the development of measures to manage dirt and debris being transferred to roads.

Due to the distance between the project area and MNES, there is not expected to be any impact to MNES as a result of changes in traffic conditions during operation.

Light

Light spillage impacts have been considered in EES Technical Report D *Ecology: Project Areas* where it was identified there was a negligible risk of light spillage on vegetation and habitat. EPR_FF5 was developed to provide protection of retained/adjacent vegetation and includes directional lighting as a measure to minimise unintended impacts on adjacent vegetation or habitat to be included in the Construction Environmental Management Plan (CEMP).

EES Technical Report J *Landscape and Visual* found that night lighting would be used during the construction period. The distance (over 1 kilometre) between the high value GDEs which are known to support threatened species and the project area where night lighting occurs is such that no impacts are anticipated. EPR_LV3 was developed to include measures to minimise light spillage into adjacent areas during the construction period.

6 CONCLUSION

The EES determined that significant impact to MNES is unlikely.

This is based on the following:

- Suitable habitat for threatened species is not present within or immediately adjacent to the project areas.
- Groundwater modelling shows no impact at Edithvale Wetland or Wannarkladdin Wetlands.
- High value GDEs known to support threatened species are located beyond the area of influence of disturbance associated with the project. The disturbances considered included noise and vibration, contamination, dust, surface water change and sedimentation and/or light spill.

ATTACHMENT IV
LXRA CORPORATE POLICIES

SECTION PAGE

LXRA Sustainability Policy IV.2

Department of Economic Development, Jobs, Transport and Resources Environmental Policy IV.3

LXRA Urban Design Framework IV.5

LXRA Sustainability Policy

In 2015, LXRA adopted a Sustainability Policy to ensure the principles of environmental, social and economic sustainability were included in all our projects. LXRA has become a member of the Infrastructure Sustainability Council of Australia and the Green Building Council of Australia and is requiring the LXRA projects to obtain independent certification using their respective sustainability rating tools.

In doing this, our projects will:

- be undertaken by contractors that have accreditation to ISO 14001 (Environment), ISO 9001 (Quality) and AS/NZS 4801 (OH&S) and who regularly monitor their performance;
- undertake a climate change risk assessment and respond to any extreme or high priority climate change risks
- reduce Greenhouse Gas Emissions by 15-25%
- minimise the use of potable water wherever possible
- minimise waste by using the waste hierarchy of avoidance, reduction, reuse and recycling.

Our Sustainability Vision is to achieve excellent environmental, social and economic outcomes across all phases of the Level Crossing Removal Project (Project) in order to deliver an integrated Project that connects the community in an environmentally sustainable manner.

To achieve this sustainability vision, the Level Crossing Removal Authority is committed to:

- Optimising the Project's design to ensure it is delivered to operate sustainably;
- Managing resources efficiently through embedding energy, water and material saving initiatives into the design, construction and operation of the Project;
- Avoiding, minimising and offsetting harm to the environment and the loss of biodiversity;
- Protecting and conserving the natural environment; and
- Preparing for the challenges presented by climate change.

To give effect to this policy, our people will:

- Demonstrate leadership in the commitment to a prosperous and integrated economic, social and environmental sustainable future;
- Demonstrate commitment to sustainable procurement;
- Protect and maintain ecosystems and biological diversity, while seeking opportunities to enhance the value of these natural systems within the context of our works;
- Facilitate economic prosperity and development and provide a resilient local workforce;
- Support and enhance social, cultural and community wellbeing;
- Encourage the pioneering of innovation in sustainable design, process or advocacy that seeks continuous improvement to promote new ideas and thinking;
- Embed environmental and sustainability outcomes by establishing robust sustainability objectives and targets; and
- Report on sustainability performance and be accountable for meeting environmental and social responsibilities.

The CEO of LXRA fully endorses this policy.

Department of Economic Development, Jobs, Transport and Resources Environmental Policy

Introduction

This policy aims to reduce both current and future environmental impacts of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) through both staff behavioural change and infrastructure improvements.

Scope

This policy is applicable to all operations and services of the department at all locations. Agencies linked to the department are expected to comply with the spirit of this policy in the context of the organisation in which they work.

Policy statement

The Environment policy has been developed to increase awareness of the environmental impacts that the organisation faces and to demonstrate commitment to further reducing these impacts over time.

DEDJTR has responsibility for more than 80 sites across Victoria. The 2015 Annual Report demonstrates that the department is responsible for environmental impacts associated with:

- consuming 130 million megajoules of electricity and gas
- consuming 110,000 kilolitres of water
- travelling around 10 million kilometres by car
- generating around 130,000 kilograms of office waste
- purchasing 40,000 reams of paper
- emitting 30,000 tonnes of greenhouse gases.

Staff are required to familiarise themselves and act in accordance with the Environment policy.

Principles

Emissions: actively identify and implement (where practical) improvements to minimise the production of greenhouse gases through our everyday activities.

Consumption: actively identify and implement (where practical) improvements to minimise consumption and promote efficient use of energy, water, paper and other material inputs.

Waste: strive to reduce the amount of waste produced whilst maximising the amount we reuse and recycle.

Procurement: incorporate environmental principles and, where possible, life cycle costing when procuring goods and services and request that suppliers remove and reuse packaging when goods are procured in bulk.

Transport: consider environmental factors when purchasing and using fleet vehicles and travel sustainably when practical.

Infrastructure: ensure all new capital works programs and office relocations incorporate comprehensive environmental sustainability principles.

Compliance: comply with all relevant environmental legislation, regulations and policies.

Monitoring: monitor and review our environmental performance against annually reviewed targets. Improve the quality of data collected and reported.

Communication: communicate our environmental performance to all staff and stakeholders whilst encouraging participation and feedback.

Procedures

Staff are expected to:

- save energy
- utilise smarter travel
- utilise greener procurement
- save water
- utilise waste and recycling systems
- save paper.

Any issues/concerns can be raised with environment representatives or the Environment Manager.

Environment representatives are expected to:

- communicate environmental information to staff
- encourage staff to behave in an environmentally responsible manner and participate in environmental initiatives
- ensure new staff members are aware of their environmental responsibilities
- act as a point of contact for staff and report issues/concerns to the Environment Manager.

There should be at least one environment representative for each floor / location occupied by the department (where practical).

The Environment Manager is expected to:

- maintain the Environmental Management System (EMS) and related documentation
- provide quarterly and annual report information to senior management
- organise and implement environmental staff behaviour change campaigns
- provide environmental support and guidance to all staff when required
- monitor, measure and publicly report environmental performance
- identify risks to DEDJTR's environmental performance
- set annual targets to further reduce all environmental impacts
- ensure new capital works programs incorporate comprehensive environmental sustainability principles
- ensure operational activities comply with environmental legislation, government policy and relevant departmental environmental procedures and guidelines.

Managers are expected to:

- provide feedback to the Environment Manager on quarterly and annual reports
- ensure the Environment policy appropriately articulates the department's commitments
- support the implementation of the EMS
- identify opportunities to embed environmental sustainability throughout the department's activities.

Glossary/definitions

Environmental Management System (EMS) – this is a structured system or management tool which, once implemented, helps an organisation to identify the environmental impacts resulting from its business activities and to improve its environmental performance. The system aims to provide a methodical approach to planning, implementing and reviewing an organisation's environmental management.

Environmental aspects – elements of an organisation's activities, products and services that can interact with the environment, that is, have a negative or positive environmental impact. These are recorded in the Environmental Aspects and Impacts Register.

Environmental legal requirements – legal and other requirements relating to environmental performance must be identified, and kept up to date in the Environmental Register of Legal and Other Requirements.

Environmental objectives and targets – these are the overall goals that an organisation sets itself to achieve. Environmental targets are detailed performance requirements that arise from the environmental objectives.

Standard operating procedures – the standard procedures that staff need to follow which are outlined in the EMS in order to achieve compliance.

For more information, visit the Department of Economic Development, Jobs, Transport and Resources policy framework at https://economicdevelopment.vic.gov.au/about-us/overview/policy-framework.

LEVEL CROSSING REMOVAL AUTHORITY

URBAN DESIGN FRAMEWORK:

PRINCIPLES & OBJECTIVES, MEASURES & QUALITATIVE BENCHMARKS

Version 3

15 AUGUST 2016

LEVEL CROSSING REMOVAL PROJECT

State Government Victoria

VERSION 1	13 August 2015	Initial issue
VERSION 2	11 March 2016	General update with new chapter for Integrated Development Opportunities
VERSION 3	15 August 2016	General update with inclusion of Implementation section

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1. EXECUTIVE SUMMARY

1.1 SUMMARY

Over the next eight years, the State Government will deliver a coordinated program to remove 50 of the worst level crossings in Melbourne, improving safety and urban amenity in local communities whilst improving the efficiency of the local transport network. The Level Crossing Removal Authority (LXRA) has been created to deliver this program along with associated projects such as the Mernda Rail Extension and other future projects as allocated. Integrated development opportunities identified by LXRA will also be facilitated where they can provide improved urban renewal and transit-oriented outcomes for the benefit of the community.

This Urban Design Framework (UDF) establishes the expectations of the State and Local Governments for high quality, context sensitive urban design outcomes from the project. The document will be used to inform and influence the design process as well as providing the basis for evaluation of proposals. Proponents are expected to prepare locally relevant framework plans using the principles, objectives, measures and qualitative benchmarks contained within this document.

The UDF identifies eight key **principles** that are aligned with other level crossing removal projects across Melbourne. These principles address identity, connectivity, urban integration, sustainability, amenity, vibrancy, safety and accessibility.

Flowing from these principles are more detailed urban design **objectives** for the project, and **performance measures** to assist in achieving them. These are supported by **qualitative benchmarks** from relevant precedents.

1.2 REPORT STRUCTURE

The Urban Design Framework document has been organised into nine chapters:

1. Executive Summary

This chapter provides a summary of the overall urban design vision for the project.

2. Introduction

This chapter outlines the background, purpose, vision and key government policies that inform the project.

It also discusses the importance of good urban design and its integral role in the project.

3. Framework Structure

This chapter identifies the five key components of the urban design framework, in three sections:

- Urban Design Principles and objectives
- Local Considerations
- Urban Design Measures and Qualitative Benchmarks.

4. Principles and Objectives

This chapter presents eight urban design principles that provide the overarching framework for the urban design response. The eight principles are supported by a series of objectives which identify expectations in more detail.

5. Local Considerations

This chapter draws attention to the importance of local considerations for each site and affected area, and to the importance of context responsive solutions.

6. Measures and Qualitative Benchmarks

This chapter articulates the urban design measures as the overarching performance requirements for urban design outcomes resulting from all of the project works. These should be read together with the qualitative benchmarks which illustrate the quality of outcomes that are expected.

7. Implementation

This chapter outlines initiatives that will support the delivery of high quality, integrated urban design outcomes.

8. References

The final chapter provides information on images used throughout the document.

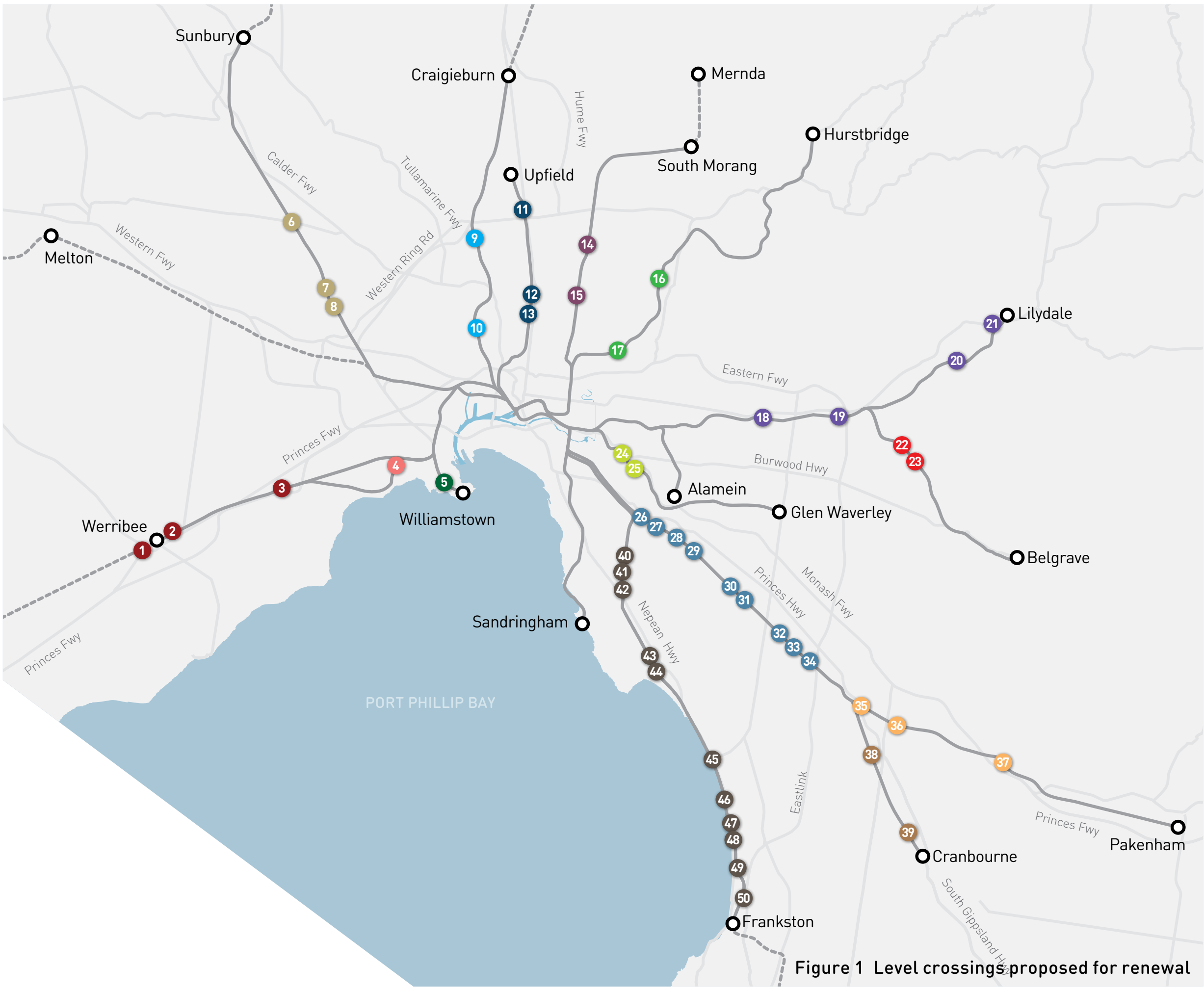


Figure 1 Level crossings proposed for renewal

2. INTRODUCTION

2.1 BACKGROUND

The Victorian State Government and Local Government Authorities wish to develop local communities around Melbourne that are prosperous, safe and vibrant – great places to be.

The Level Crossing Removal Authority (LXRA) was formed in May 2015 to coordinate the Level Crossing Removal Project and associated projects such as the Mernda Rail Extension and other future projects as allocated. The LXRA has commenced the design process for 50 sites across Melbourne. These level crossing removal projects will be significant infrastructure assets for Melbourne with a functional life of more than 100 years. As a major legacy project, it is critical that the best possible outcome for the transport network is achieved, and that all users benefit through the experience of better public places.

2.2 VICTORIA'S MAJOR TRANSPORT INFRASTRUCTURE PROGRAM

The Major Transport Infrastructure Program represents one of the most significant investments in transport infrastructure in Victoria's history. The program, comprising projects that are being undertaken by the Level Crossing Removal Authority (LXRA) and the Melbourne Metro Rail Authority (MMRA) are more than just road or rail projects, they are city shaping projects that will create a lasting legacy for Melbourne. Incorporating the principles and practices of great urban design and place making is therefore a priority if this investment is to deliver a full range of benefits for current and future Victorians.

The Office of the Victorian Government Architect (OVGA) advocates for good design to be a priority throughout the project lifecycle, and has been actively involved in the development of the Major Transport Infrastructure Program. The OVGA is embedded in project teams, working with the LXRA and MMRA to develop strategies, advocating for good design and sharing learnings across the program.

Both LXRA and MMRA are working with the OVGA to develop a design approach that will consist of a number of pillars:

- Common vision: develop an overarching design vision for major transport infrastructure projects.
- Accountability: prepare urban design documents to guide the planning, design and evaluation of major transport projects.
- Transparency: undertake a program of stakeholder and community engagement to inform the design of major transport infrastructure projects, including identifying key local considerations and opportunities to involve the community, including young people, in the projects.

- Governance: seek expert design advice through the whole of project life-cycle, retaining consistent design expertise from the OVGA, industry and stakeholders at all stages of the project including development, procurement and delivery.
- Independent design review: use the Victorian Design Review Panel at key milestones throughout the project lifecycle.

The Level Crossing Removal Project Urban Design Framework and Melbourne Metro Urban Design Strategy are both based on this approach.

2.3 PURPOSE

This Urban Design Framework (UDF) document establishes the expectations of the State and Local Governments for high quality, context sensitive urban design outcomes from the project.

The aim is to achieve a high quality urban design response which enhances urban amenity and minimises adverse impacts which may result from the proposed project and its associated structures.

The environments through which the rail corridor passes are a mixture of industrial, suburban and highly urbanised areas, with strong, established characters and attributes. They also bear significant potential for urban renewal. It is essential that the project results in improved quality and a positive, authentic contribution to existing urban character and amenity.

Designs must address both the rail and road infrastructure and the communities and places through which the project passes.

This process seeks private sector expertise and innovation in creating outstanding urban design outcomes, through an integrated and collaborative design approach in developing technical proposals.

The role of the Urban Design Framework is to guide the planning and design of the proposed project infrastructure, and to evaluate urban design proposals.

Rather than providing prescriptive urban design solutions, this UDF articulates what is to be achieved in terms of urban design quality and performance.

2.4 PROJECT VISION

These principles, objectives, local considerations, measures and qualitative benchmarks articulated in this UDF are provided to:

- Ensure proposals develop with good urban design considerations treated as being integral to project solutions;
- Articulate the basis for the Urban Design review team to provide feedback during the interactive bid process;
- Support the RFP evaluation criteria for Urban Design including Value Capture;
- Establish the minimum quality expected by the State in terms of performance outcomes and benchmarks for quality.

The Urban Design Framework is based upon the following aspirations:

- **Achieve urban design excellence** that benefits all of the transport network, its users and the communities and places through which the project passes
- **Maximise positive impacts** and minimise negative impacts resulting from the project
- **Provide thorough integration** of high quality urban design with best practice technical solutions
- **Develop collaborative, multi-disciplinary, integrated design thinking** for the project through an urban design led process

The UDF is a living document that will be updated as the level crossing removal program progresses.

2.5 POLICY CONTEXT

Policies relevant to the urban design aspirations and requirements for the proposal include but are not limited to:

- Regulation, Governance and Law Division, Victorian Department of Transport - 'Transport Integration Act 2010'
- Australian National Urban Design Protocol - 'Creating Places for People'
- Victorian 'Urban Design Charter' 2009
- Department of Environment, Land, Water & Planning - 'Plan Melbourne, Metropolitan Planning Strategy' 2014 and upcoming amendment
- Office of the Victorian Government Architect Publication - 'Good Design + Transport, Issue 05' 2012
- Public Transport Victoria - 'Network Development Plan' and other relevant policies
- Department of Environment, Land, Water & Planning -'Safer Design Guidelines'
- Department of Environment, Land, Water & Planning -'Activity Centre Design Guidelines'
- Economic Development, Jobs, Transport and Resources- 'Public Transport Guidelines for Land Use Development'
- Creative Victoria - 'Creative Industries Strategy'
- Other local planning policies and strategies

2.6 WHAT IS URBAN DESIGN AND WHY IS IT IMPORTANT?

Urban design is the practice of shaping the built environment to improve the quality and overall liveability of cities and towns. Whilst urban design is often tailored for a specific project, the dynamic and evolving nature of urban environments means that urban design is in fact a long term process.

Urban design operates on a variety of scales; from the macro scale of urban structures considering elements such as city-wide transport networks to the micro scale considering elements such as lighting. Good urban design employs a multi-disciplinary approach to create integrated and considered environments and often involves transport, planning, architecture, landscape architecture, engineering and finance expertise.

Urban design is important because of its potential to significantly influence:

- The functionality, character and spirit of public places for individuals and communities;
- The levels of comfort, accessibility, safety and inclusiveness of places;
- The expression of social and cultural values associated with places;
- The socio-economic composition, diversity and economic vibrancy of urban areas;
- The sustainability and resilience of urban environments;
- Community connectedness, health and well-being, and pride of place.

Altering the urban environment can be challenging and costly. When urban design is incorporated as a key consideration in developing technical solutions from the outset, better urban outcomes result at minimal cost.

The Victorian Government is committed to the removal of 50 of the most dangerous and congested level crossings on the metropolitan rail network to reduce congestion across the road network and improve safety for Victorians. The LXRA seeks the best in local and international private sector expertise to deliver the Level Crossing Removal Project.

Victoria is internationally recognised as a leader in the design quality of its urban environment, and as a liveable city. The Victorian Government is committed to enriching this reputation by ensuring high quality, innovative urban design outcomes are delivered through all infrastructure projects.

The project will have a significant impact on the condition and amenity of both established and developing urban areas. It is expected that the Project will improve urban quality in affected areas through integrated, responsive design solutions to local sites and to the corridor as a whole.

The project will also be instrumental in demonstrating positive benefits of densification by releasing land for well designed, integrated development through the Value Capture component of the project.

It is expected that development will contribute to improved urban amenity through incorporation of good urban design approaches, to ensure site responsive, locally relevant higher density development. This project has the potential to set strong benchmarks for design quality in urban renewal and to serve as a catalyst for positive urban renewal that reinvigorates and reconnects communities.

2.7 URBAN DESIGN VISION

The overarching urban design vision for the project is that all places affected or constructed through the project will benefit from design solutions that integrate technical aspects with innovative, responsive, high quality urban design approaches, to create:

- Comfortable, legible and welcoming public places;
- Vibrant, engaging, inclusive places for people to actively and positively use;
- Places that feel and are safe to move through and be in;
- Places that are walkable, cycleable and fit for purpose;
- Places that designed as authentic, site responsive and appropriate solutions;
- Places that are sustainable, enduring and will age gracefully;
- Places that are designed to connect the community physically and socially;
- Places that contribute to and enhance the local economy through improved urban quality and high quality design.

3. FRAMEWORK STRUCTURE

The Urban Design Framework is comprised of five components, in three sections.

The five components will be used for evaluation and assessment of design proposals as they develop throughout the process through to delivery.

	What are these?	What are they used for?
PRINCIPLES	High level, overarching principles from Federal and State Government documents such the National Urban Design Protocol and the Urban Design Charter.	Identify broad concepts about good urban design.
OBJECTIVES	These are drawn from the Federal, State and Local Government policy frameworks and strategies. These are amended to specifically address aspects of the project.	Outline what the project should achieve.
LOCAL CONSIDERATIONS	The site and community specific information that requires investigation, analysis and understanding for each site and affected area.	To form the foundation for contextually responsive project solutions.
MEASURES	The detailed requirements for UD performance to achieve the Principles and Objectives, in responsive solutions to local considerations.	Provide performance requirements as the basis upon which UD proposals will be developed and evaluated.
QUALITATIVE BENCHMARKS	Qualitative benchmarks to illustrate the minimum standard of design quality expected of project outcomes, drawn from relevant precedent projects.	Illustrate the level of quality that is expected in meeting the urban design measures – in terms of design integration, innovation and detailed resolution.

4. PRINCIPLES AND OBJECTIVES

Urban design outcome
ENHANCING

Principle 1
IDENTITY

A well defined identity and sense of place are key to creating strong and vibrant communities.

Objective 1.1 Sense of Place

Recognise, maintain and enrich the identity, character and individuality of neighbourhoods and communities through which the project passes, through responsive, high quality architecture, landscape and urban form.

Objective 1.2 Responsive

Integrate new transport infrastructure to ensure it responds sensitively and contributes positively to social, cultural, functional and physical aspects of local areas.

Objective 1.3 Heritage

Recognise, respect and preserve indigenous and non-indigenous cultural heritage and local history through protection and responsiveness to heritage values.

Objective 1.4 Journey

Provide a distinctive and authentic civic identity for the rail corridor that enhances the journey, creating an engaging and memorable public transport experience for commuters, and demonstrating sensitivity to interfaces with neighbours.

Urban design outcome
CONNECTED

Principle 2
CONNECTIVITY & WAYFINDING

Well connected and legible places contribute significantly to strong economies and healthy, inclusive communities.

Objective 2.1 Connectivity

Improve connectivity through the immediate and wider precinct with safe, ample and efficient physical linkages to increase precinct permeability across and along the corridor for all modes, including pedestrians and cyclists.

Objective 2.2 Seamlessness

Design to accommodate waiting areas and ease of movement between spaces for all users through integrating transport linkages with direct connections, clear sightlines and efficient transitional spaces.

Objective 2.3 Legibility

Ensure legibility though an urban design response that supports intuitive wayfinding, and through a hierarchy of pathways that is easy to understand and navigate, reducing reliance on signs.

Objective 2.4 Public transport

Support and enhance effective inter-modal connections for all commuters to public transport, including pedestrians, cyclists, and cars.

Urban design outcomes from *Creating Places for People - an Urban Design Protocol for Australian Cities*

Urban design outcome

DIVERSE

Principle 3

URBAN INTEGRATION

Well-integrated environments provide a sound framework for the successful development of great places.

Objective 3.1 Integration

Provide an integrated design transport infrastructure and land-use solution that shows a clear analysis of and responsiveness to the existing context, and demonstrates alignment with strategic visions / plans of the Government and the community.

Objective 3.2 Reconnect

Reconnect pedestrian and cycling networks where severed by previous civil interventions to deliver greater permeability and connectivity, and ensure resolution of the road-rail separation does not result in additional unforeseen dislocations.

Objective 3.3 Urban renewal

Ensure all new works make a positive contribution to enhance local areas by developing innovative, high quality propositions for urban renewal challenges and opportunities in each location.

Objective 3.4 Future-proofing

Support and enable appropriate, positive, future development and anticipated transport change in affected and surrounding areas through strategic design of transport infrastructure.

Objective 3.5 Consultation

Enhance the quality of project outcomes through working closely with affected stakeholders and the community to identify and prioritise key local contextual issues and opportunities.

Urban design outcome

ENDURING

Principle 4

RESILIENCE & SUSTAINABILITY

Places must be sustainable, enduring and resilient in order to support and nurture current and future generations.

Objective 4.1 Enduring & durable

Provide a design that is enduring and functional for generations to come, is readily maintainable, and will age gracefully in concept and detail, ensuring a positive built legacy.

Objective 4.2 Sustainable

Promote positive and relevant environmental, social, cultural and economic values, assessing long term life cycle implications to ensure a high level of sustainability.

Objective 4.3 Environmental sustainability

Employ environmentally sustainable design to minimize water and energy usage, to reduce climate change impacts and to protect and improve sustainability in the natural and built environment.

Objective 4.4 Pollution mitigation

Enhance the quality of the surrounding environment by designing to mitigate negative impacts including those associated with noise, spilled light, air and visual pollution.

Objective 4.5 Governance

Through effective governance arrangements, work together with stakeholders in surrounding areas to address integrated land use, transport and on-going management issues at the design stage of the project.

Urban design outcome

COMFORTABLE

Principle 5

AMENITY

High quality urban amenity associated with access to services and the experience of great public places contributes to successful, equitable and prosperous communities.

Objective 5.1 Improved amenity

Enhance existing urban amenity through a highly considered response to the existing place and provide a design outcome that addresses the challenges and opportunities inherent in the social, cultural, functional and physical aspects of the precinct.

Objective 5.2 Comfort

Provide a design that effectively caters for the physical comfort and psychological wellbeing of users.

Objective 5.3 High quality

Provide a high quality design outcome that makes a positive contribution to the local built and landscape context, through a well-considered conceptual approach, design resolution and construction detail.

Urban design outcome

VIBRANT

Principle 6

VIBRANCY

Animation of key civic spaces, and diversity in the experience of urban places support prosperous and healthy communities.

Objective 6.1 Putting people first

Address and support social and cultural aspects of the local community through the responsive and innovative design of an integrated public realm that is welcoming, inclusive, and appropriate to its locale.

Objective 6.2 Public realm

Create memorable, engaging and accommodating spaces and places in the public realm, through sensitive, high quality urban design.

Objective 6.3 Range of experiences

Create an integrated, legible public realm that provides a range of experiences and is accessible over different times of the day and different times of the year.

Urban design outcome

SAFE

Principle 7

SAFETY

Safe environments are essential for strong, connected and happy communities.

Objective 7.1 Personal safety

Significantly improve real and perceived personal safety in all affected areas through the application of passive, integrated Crime Prevention Through Environmental Design (CPTED) principles.

Objective 7.2 Perception of safety

Design to engender pride of place, and to result in outcomes that age gracefully, ensuring materials, products and detailing are easily maintained and not conducive to vandalism.

Objective 7.3 Visual connectivity

Maximise visibility and visual connections through design for clear sightlines and direct, intuitive site navigation routes, minimising obstructions including those associated with overpasses, underpasses and hidden corners.

Objective 7.4 Direct routes

Provide access routes which are direct, legible and easily navigable to ensure that users do not encounter dead-ends, and have clear, safe options to easily enter and exit from public spaces.

Urban design outcome

WALKABLE

Principle 8

ACCESSIBILITY

Highly accessible and inclusive environments encourage positive activation and contribute to prosperity, well being and the perception of care within communities.

Objective 8.1 Universally inclusive

Enhance universal accessibility through the affected and surrounding immediate and extended precinct for all members of the community, through fully integrated design solutions, without perceived or physical barriers or differentiation.

Objective 8.2 Walkable

Create generous, functional pathways and accommodating, usable public spaces, designed to prioritise pedestrian activity and connections across and between transport corridors, including linkages to local streets and networks.

Objective 8.3 Active transport

Provide a design that is conducive to and prioritises walking, cycling and public transport usage.

5. LOCAL CONSIDERATIONS

The individual sites encompassed by the project should be viewed as specific and distinctive opportunities to improve local places, while also forming part of the rail corridor and the associated journey. Effective enhancement of local places requires an understanding of existing character including physical conditions as well as strategies, plans and values that exist within local communities.

Each site, whether it be a level crossing removal, new station or associated development site, has its own unique character and 'sense of place', and there are distinctive issues and opportunities inherent in each place in terms of their urban design quality. The design for each site, and each area affected by the project, should take into account the unique characteristics , issues and opportunities that exist within a location and its community. In addition, consideration should be given to the dynamism of communities and to the needs of those who may live in and use these areas in future.

It is expected that proponents will undertake careful analysis of existing context through site investigation and research as appropriate, in order to understand local issues and opportunities to enhance and contribute to better local outcomes. It is expected that this will include analysis of each existing site, associated precincts and the corridor as a whole in order to establish a sound basis for a responsive design solution to level crossing removals and to any integrated development opportunities.

In some cases there is an opportunity to establish a new landmark built form within an existing activity centre, where a strategic redevelopment site is available as a result of the removal of a level crossing. Development must demonstrate a net community benefit and high quality architectural response.

Key local considerations for each site have been identified by Councils officers and the community as part of consultation processes. In many cases local considerations and feedback is captured using an online mapping tool called 'Social Pinpoint'.

In summary, local considerations specific to individual sites and areas affected by the projects are to be researched and analysed as the foundation for responsive design proposals.

Proponents should access material including:

- Information identified with input from Council and the local community;
- Report on LXRA Interactive Community Engagement;
- Site context analyses;
- Research of other publicly available material, including relevant local Council's policies and plans;
- Engagement with other key stakeholders.

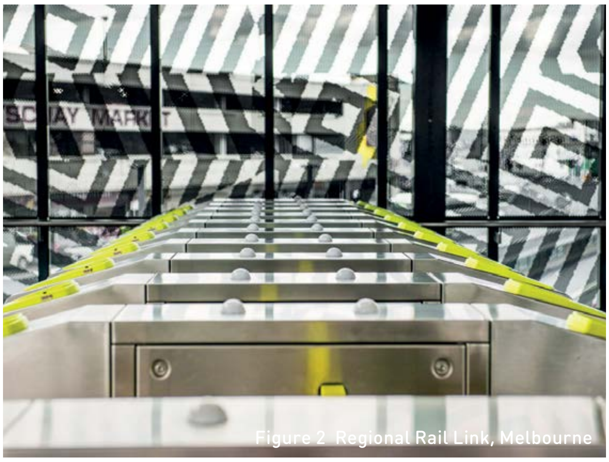


Figure 2 Regional Rail Link, Melbourne

Figure 3 Regional Rail Link, Melbourne

Figure 4 Regional Rail Link, Melbourne

Figure 5 Regional Rail Link, Melbourne

Figure 6 Regional Rail Link, Melbourne

6. MEASURES AND QUALITATIVE BENCHMARKS

6.1 WHOLE OF PROJECT

6.1.1 Provide a high quality, well-resolved design outcome; and an innovative urban design response which is enduring in expression and timeless in nature, for road and rail users, surrounding land users and for Melbourne as a whole.

- *The design is to make a positive contribution to locally affected environments, to the rail corridor, and to greater Melbourne's cultural identity and reputation for design innovation and excellence.*
- *The whole of the project is to be well conceived, carefully resolved and finely executed in detail, as a design which is responsive, engaging, environmentally sustainable, functional, and adaptable for future infrastructure needs.*
- *All structural, functional and service elements are to be resolved and integrated in a context sensitive manner as part of the urban design solution.*
- *The design is to ensure particular attention to successful integration and responsiveness to the existing landscape(s), cultural heritage, land use, the character and integrity of key precincts along the alignment, and overall coherence and identity.*
- *Incorporate sustainable design approaches into the project as a whole, and to its elements. Consider materials for the design that minimise embodied energy use, and maximise positive impacts.*

6.1.2 Provide a high quality outcome for residents and adjacent private and public land users with respect to protection of views and privacy, noise amelioration, minimising overshadowing, and providing access and security through design.

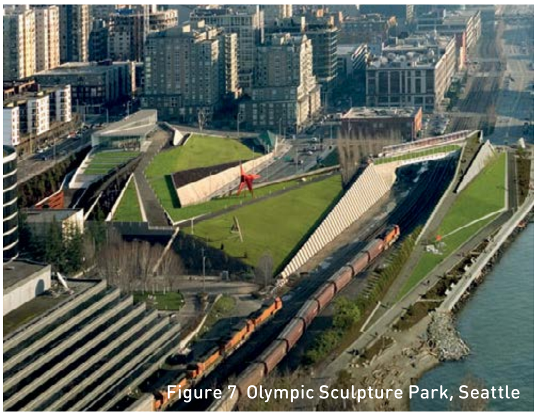


Figure 7 Olympic Sculpture Park, Seattle

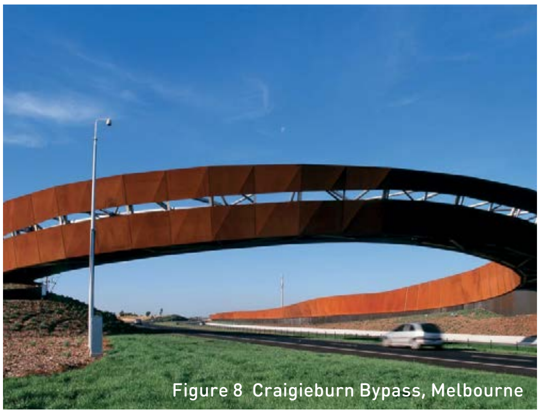


Figure 8 Craigieburn Bypass, Melbourne

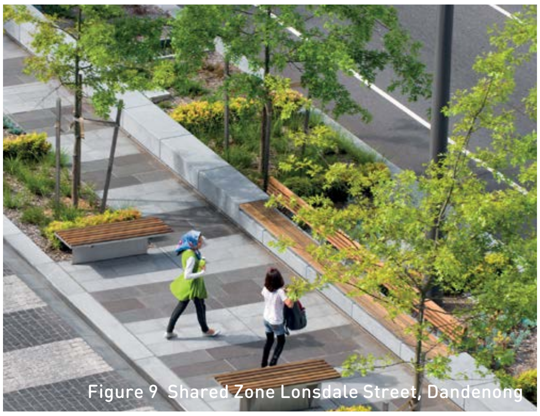


Figure 9 Shared Zone Lonsdale Street, Dandenong

6.1.3 A sense of journey for the corridor is to be created through an integrated landscape, architectural and urban design response, including the development of a palette of forms, treatments and materials for elements for the whole corridor or for key precincts within it as appropriate to the concept design intention, including:

- *Roads, bridges and elevated structures;*
- *Noise barriers, retaining walls, abutments, fencing and barriers;*
- *Pedestrian and cyclist paths;*
- *Earth forming, planting and open space elements, including open cuttings;*
- *Associated urban design elements including signage, lighting and any furniture.*

6.1.4 The form, finishes and siting principles for all rail, road and street furniture, lighting, signage housings and other miscellaneous items are to be established at the concept stage of the design. These should be rationalised to minimise visual clutter, and designed as integral to the urban design concept, or aligned with local palettes as appropriate.

6.1.5 The architectural, landscape and urban design works are to be carefully considered to provide an environment which is accessible, inclusive, supports safe behaviour, and is perceived as being safe.

Figure 10 Newtown Interchange, Sydney

Figure 11 PARK[E]ING, Venice

Figure 12 Gloucester Reserve WSUD, Melbourne

6.2 TRAIN STATIONS

6.2.1 Design stations to optimise their dual role as service points for public transport infrastructure and as public places of pivotal spatial significance within the local area. Station design shall provide high quality civic places that:

- *respond to and enhance the local context;*
- *are fit for purpose, sustainable and offer good amenity for commuters and others;*
- *are enduring in design concept and execution; and*
- *improve community connections and public spaces.*

6.2.2 Station facilities shall provide comfortable, efficient and adequate services and settings for commuters and users of the station consistent with PTV requirements, and will be robust, integrated components within the urban design concept and local solution.

6.2.3 Entrances to stations should be legible, efficient, welcoming and generous spaces that are sensitively sited and designed to enhance local context and connectivity. Station entrances are to be located to maximise inclusiveness and accessibility.

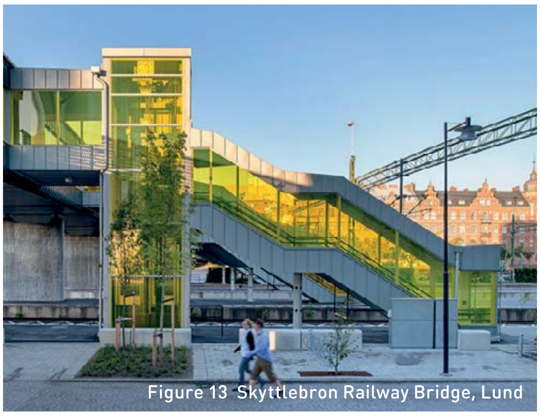


Figure 13 Skyttlebron Railway Bridge, Lund

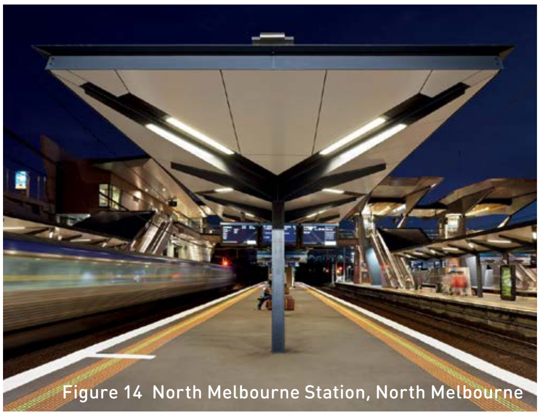


Figure 14 North Melbourne Station, North Melbourne

6.2.4 Design for direct, efficient, comfortable, safe and legible intermodal connections.

- *Adequately accommodate all relevant modes. Ensure that walking and cycling paths cater for desire lines and key flows.*
- *Ensure intuitive way finding through high visual and physical connectivity;*
- *Design waiting areas for good visual permeability and for ease of use for multi-modal transport;*
- *Provide bicycle parking facilities as an integral part of the station entry and civic space design. Cycling facilities should be safe, robust and elegant aspects of the urban design proposal in terms of spatial and detailed resolution.*

6.2.5 Integrate car parking as part of the urban design response. Ensure car parking areas are safe and positive spaces through visual connectivity and high quality landscape design.

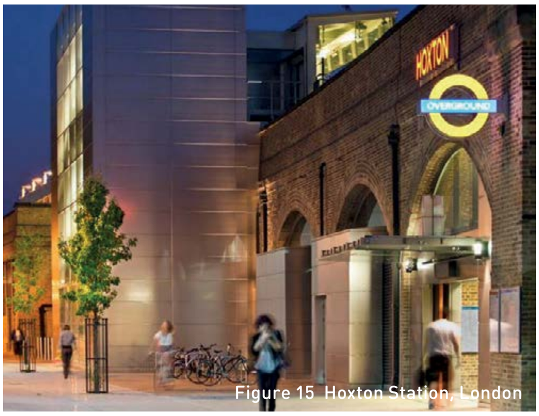


Figure 15 Hoxton Station, London

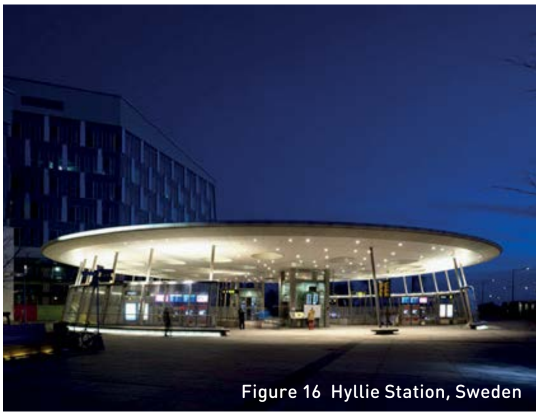


Figure 16 Hyllie Station, Sweden

6.3 BRIDGES AND ELEVATED STRUCTURES

6.3.1 Elevated structures are to contribute to urban quality, corridor identity, local identity, and provide a gateway experience at key crossings.

6.3.2 All bridges and elevated structures such as ramps are to offer integrated design solutions in terms of their form, elements, proportions and details. Structural solutions must integrate visual and spatial architectural and urban design considerations to ensure well- proportioned, elegant structural outcomes.

6.3.3 Elevated structures are to be sensitive to and respectful of context and existing urban elements, and to make a positive contribution to their environment.

6.3.4 Any new bridges, widened existing bridges, viaducts and ramps are to be designed and proportioned to complement the immediate context as part of the urban design vision:

- *Minimise negative amenity impacts on adjacent and surrounding neighbours, including public open spaces and future development sites;*
- *Design viaducts and refine profiles of decks and piers as part of the overall urban design approach;*
- *Maximise the safety and amenity of accessible areas below elevated structures, and where relevant their usefulness, through siting, visual connections, relationship to pathways and open spaces, and access to natural light;*
- *Minimise the visual and spatial impact of all services associated with elevated structures, including conduits, drainage goods and fixtures through design integration;*
- *Integrate lighting as part of the urban design strategy to contribute to identity, and to visual and spatial amenity;*

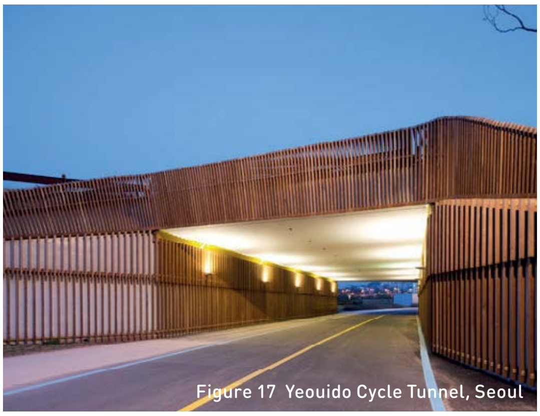


Figure 17 Yeouido Cycle Tunnel, Seoul

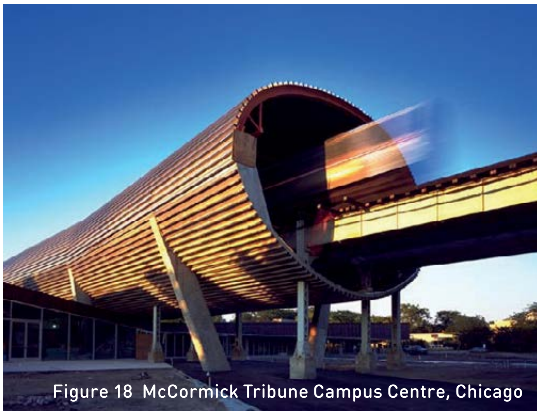


Figure 18 McCormick Tribune Campus Centre, Chicago

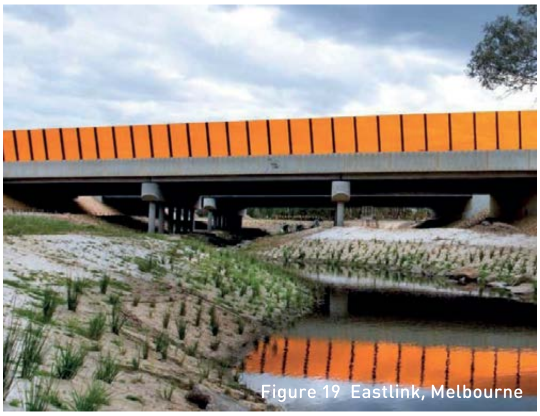


Figure 19 Eastlink, Melbourne

- *Superstructure, piers, beams and barriers are to be integrated elements within the urban design approach;*
- *Integrate to minimise visual clutter and to align with the urban design concept for the corridor;*
- *Integrate any barriers and screens as part of the technical and urban design solution, utilising high quality, enduring, robust and sustainable materials. Maximise visual permeability where possible.*

6.3.5 Design pedestrian bridges as key urban design elements contributing to identity and legibility for the corridor journey and for local areas;

- *Design for inclusiveness, accessibility and safety.*

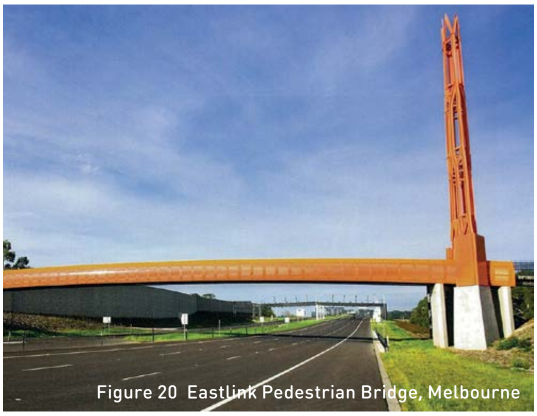


Figure 20 Eastlink Pedestrian Bridge, Melbourne

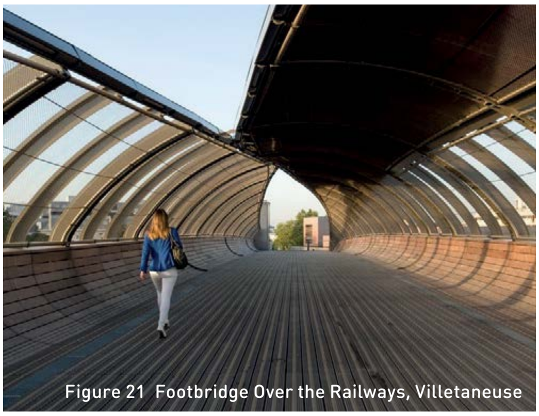


Figure 21 Footbridge Over the Railways, Villetaneuse

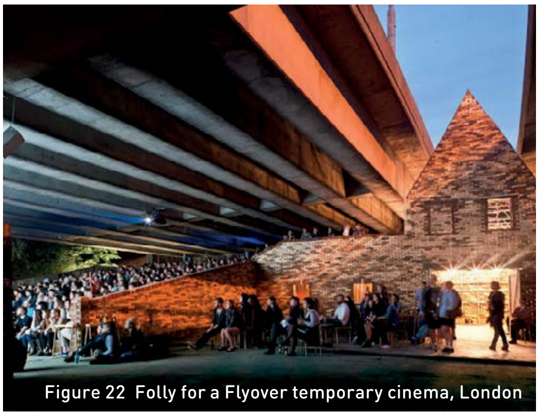


Figure 22 Folly for a Flyover temporary cinema, London

6.4 OPEN CUTTINGS

6.4.1 Minimise disconnection of communities and facilitate access to community spaces and movement networks by providing integrated linkages across cuttings.

6.4.2 Design open cuttings to contribute to the visual quality and amenity of affected areas through an integrated urban design response, with high quality hard and soft landscaping.

6.4.3 Mitigate adverse amenity impacts for adjacent residents and all users, and ensure all spaces are considered and resolved as part of the design solution.

6.4.4 Design for enhanced community connectivity as part of the holistic urban design response to improve permeability, legibility and accessibility for and across the corridor, and in and around station precincts.

- *Improve the quality and number of shared path crossings of the rail corridor cutting to better connect communities;*
- *Pedestrian and cycling overpasses should be provided at strategic points relative to the existing and any new street networks and pedestrian movement patterns;*
- *Connect and align new shared paths with the corridor where possible, and make connections to the Principal Bike Network or other bike path networks where relevant;*
- *Design for good visual connectivity, passive surveillance and aspect, and minimize visual obstruction to sightlines generally.*

6.4.5 Retaining walls should use a consistent form, design and materials palette, as integrated elements within the urban design concept, landscape design and local context.

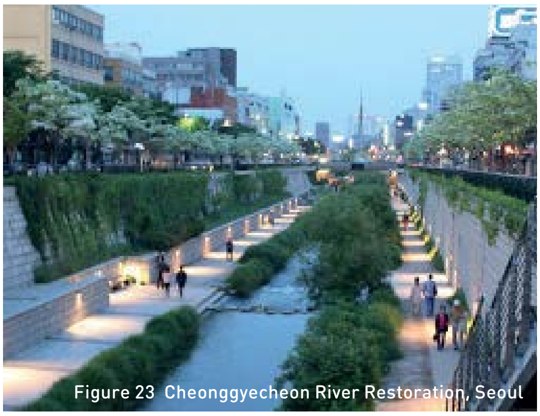


Figure 23 Cheonggyecheon River Restoration, Seoul

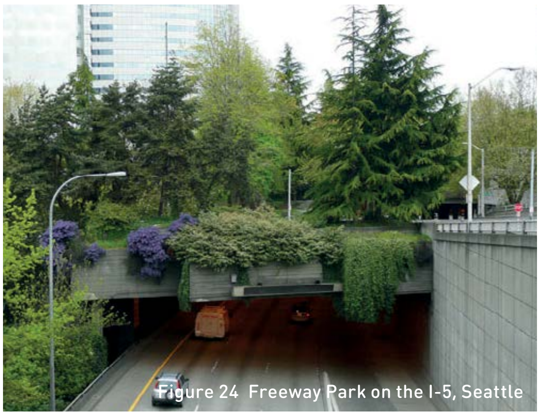


Figure 24 Freeway Park on the I-5, Seattle

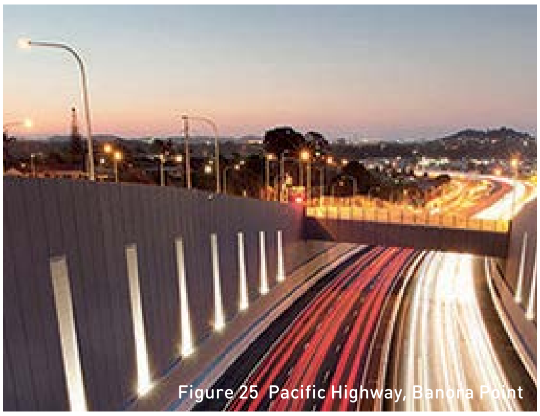


Figure 25 Pacific Highway, Banora Point

6.4.6 Design of the landscape and species selection is to integrate a palette of viable species appropriate to microclimate, and to contribute to the urban design concept and respond to local character.

6.4.7 Provision should be made for additional cutting width and decking and buildings over where possible and appropriate. The provision for future decking in the more prominent locations would help provide continuity of the public realm and urban fabric.

6.5 PUBLIC REALM AND BUILT ENVIRONMENT

6.5.1 Maximise opportunities to create, enhance and connect to existing pedestrian precincts, community and recreation facilities, public open spaces and activity centres. Improve accessibility and general amenity for the community through a coherent, legible, inclusive and continuous public realm. Ensure the introduction of project elements does not inhibit the positive development of surrounding areas, and facilitate connections between precincts and places wherever possible.

6.5.2 The introduction of any project elements into an existing environment should promote and enable positive use of open space through design.

6.5.3 New spaces created around the transport infrastructure should feel and be safe, comfortable, inclusive and welcoming to users. Employ CPTED principles.

6.5.4 The extent and alignment of the project should be designed to avoid land acquisition, where possible, particularly land used for private residences, community facilities or parkland.

6.5.5 The project design should respond to and preserve indigenous and non-indigenous heritage, and local histories through

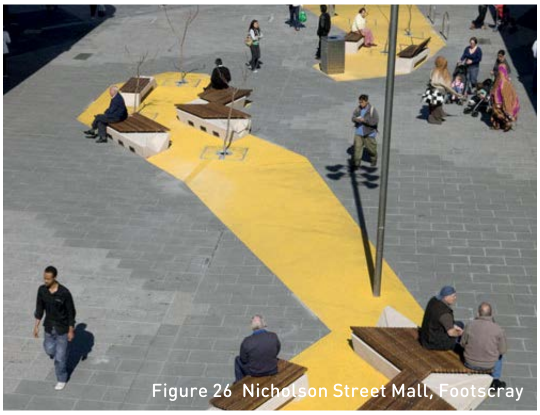


Figure 26 Nicholson Street Mall, Footscray

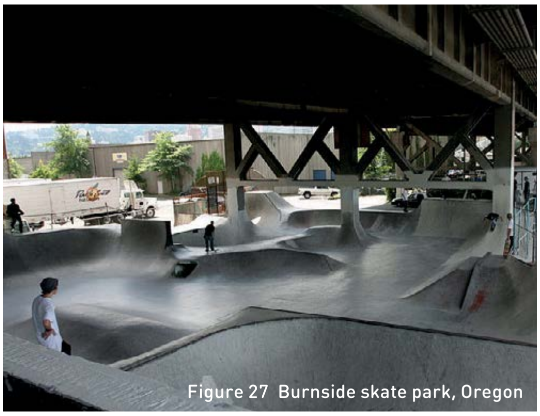


Figure 27 Burnside skate park, Oregon

Figure 28 City Square, Melbourne

acknowledgement of heritage values.

6.5.6 Create additional or enhance existing publicly accessible spaces within or adjacent to existing activity centres and transport hubs to support increasing densification and improved urban amenity.

- *Provide high quality open spaces that are comfortable and inclusive with good access to sunlight, shade and protection from wind;*
- *Provide spaces that support a diversity of active and passive uses, integrating hardscape spaces such as civic plazas for community activities and cultural events where appropriate, and softscapes such as parkland and pocket parks for passive recreation.*

6.5.7 Design to improve access to and connections between activity centre precincts that were previously disconnected by transport infrastructure.

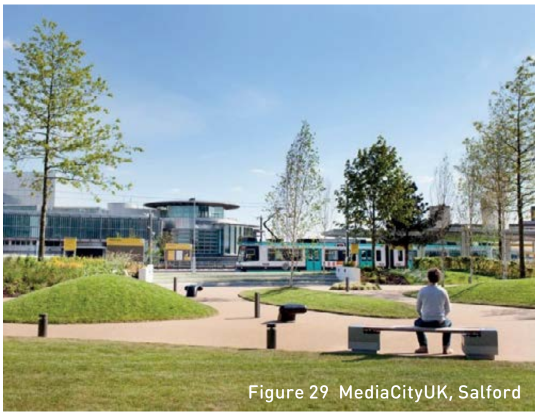


Figure 29 MediaCityUK, Salford

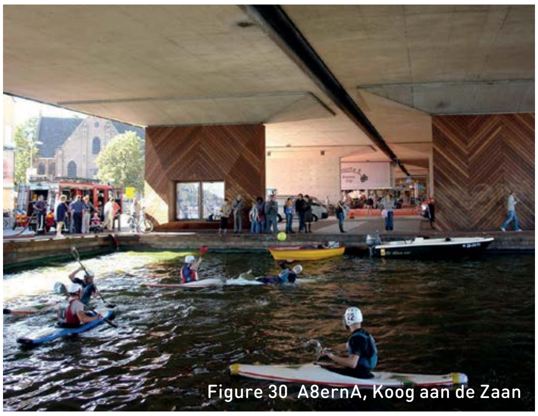


Figure 30 A8ernA, Koog aan de Zaan

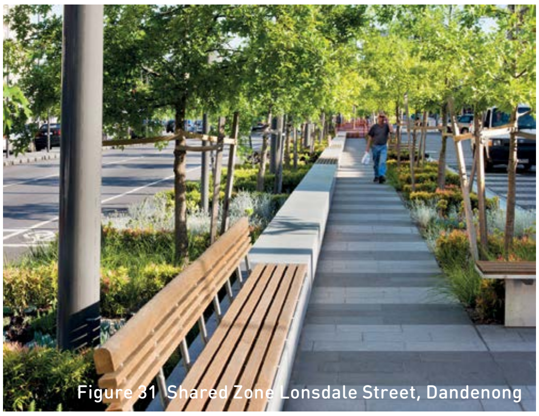


Figure 31 Shared Zone Lonsdale Street, Dandenong

6.6 LANDSCAPE AND NATURAL ENVIRONMENT

6.6.1 Enhance and contribute to the quality of existing and surrounding landscapes through a coherent landscape design concept for the corridor, the journey and for local areas.

Increase the biodiversity of flora and fauna communities along the corridor and in affected areas.

6.6.2 The design of the new transport infrastructure and siting of elements is to minimise the loss of mature trees, remnant vegetation, significant landscapes and parkland. Design is to achieve a net increase in tree canopy and contribution to the urban landscape. Plant selection, design and layout are to:

- *Present a coordinated colour, form and texture palette which is integral to the urban design concept, and relevant to each precinct or locality;*
- *Be well-implemented with appropriately selected species that ensures a low maintenance, thriving and enduring outcome;*
- *Maximise performance, long term viability and contribution to the landscape character, amenity and design concept as a whole by considering local conditions and existing character, microclimates and uses.*

6.6.3 Landscape design elements including planting and land forming should be integrated to create visual buffers between the new transport infrastructure and surrounding areas, as appropriate within the context of local areas, the urban design concept and CPTED principles.

Figure 32 Cranbourne Botanical Gardens, Melbourne

Figure 33 Buffalo Bayou Promenade, Houston

6.6.4 Planting should be self-reliant, sustainable and require minimal maintenance. Native or indigenous species should be used where possible as part of the urban design concept, in environmentally sensitive zones, and in response to local context. The palette(s) of soft landscaping and hard landscaping elements should be coordinated and consistent with local Government strategies and palettes where appropriate.

6.6.5 The new transport infrastructure and associated public realm should be designed to minimise wind tunnel effects and wind impacts generally for pedestrians, at a local level.

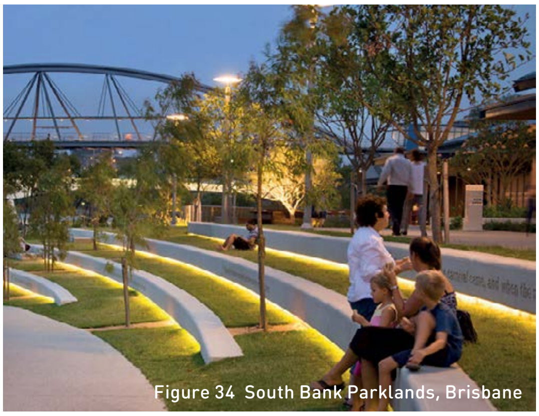


Figure 34 South Bank Parklands, Brisbane

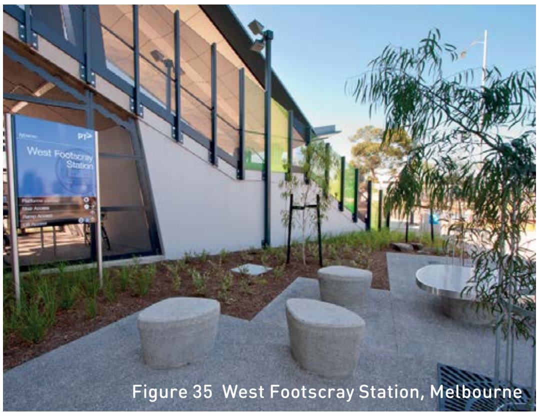


Figure 35 West Footscray Station, Melbourne

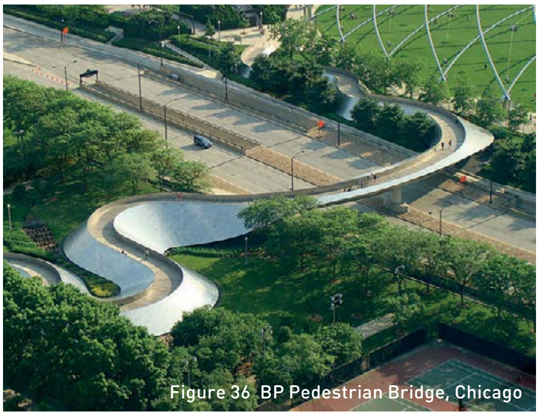


Figure 36 BP Pedestrian Bridge, Chicago

6.7 ENVIRONMENTAL SUSTAINABLE DESIGN

6.7.1 The new transport infrastructure and associated development should align with the LXRA Sustainability Policy and should use materials, delivery methodologies, and other initiatives to support environmental sustainability.

6.7.2 Achieve best practice in environmentally sustainable development from the design stage through to construction.

6.7.3 Achieve an Infrastructure Sustainability Council of Australia (ISCA) 'Excellent' rating for the project and a Green Building Council of Australia (GBCA) Four Star Rating for station buildings as identified in the project brief.

6.7.4 Encourage innovative technology, design and processes in all development, which positively influences the sustainability of buildings.

6.7.5 Integrated development opportunities are to incorporate environmentally sustainable design measures in the areas of energy and water efficiency, greenhouse gas emissions, passive solar design, natural ventilation, stormwater reduction and management, solar access, orientation and layout of development, building materials and waste minimisation.

6.7.6 Demonstrate design potential for Environmentally Sustainable Development (ESD) initiatives at the planning stage.

Figure 37 Auckland Waterfront, Auckland

Figure 38 Edinburgh Gardens Rain Garden, Melbourne

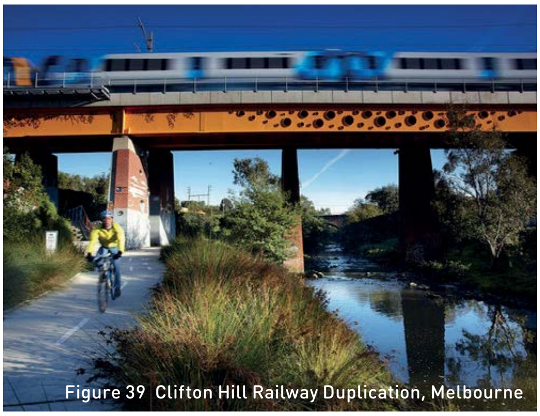


Figure 39 Clifton Hill Railway Duplication, Melbourne

6.8 PEDESTRIAN AND BICYCLE CONNECTIONS

6.8.1 Maintain, improve and enhance the existing pedestrian and cycling network with particular reference to the strategic cycling corridor along the rail corridor.

6.8.2 Any new pedestrian and bicycle paths are to maintain and extend local connectivity for all user groups,including linking to existing or new community facilities, open spaces and urban renewal areas.

6.8.3 Maximise opportunities for grade-separated pedestrian and bicycle permeability across the rail corridor, and any cuttings.

6.8.4 Ensure pedestrian priority and improved connectivity at ground level wherever possible.

6.8.5 Pedestrian connectivity under and over new transport infrastructure, spaces and places should be provided as part of a coherent pedestrian movement network, connecting local pathways and places.

6.8.6 Shared paths and pedestrian spaces are to be safe, incorporating integrated lighting where appropriate, effective passive surveillance and CPTED principles.

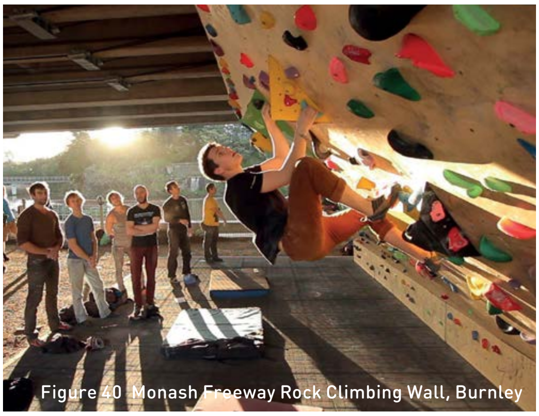


Figure 40 Monash Freeway Rock Climbing Wall, Burnley

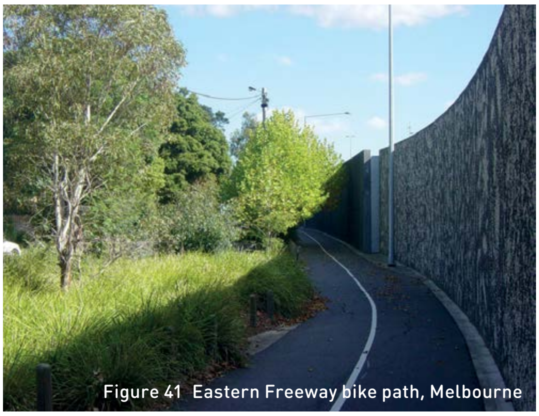


Figure 41 Eastern Freeway bike path, Melbourne

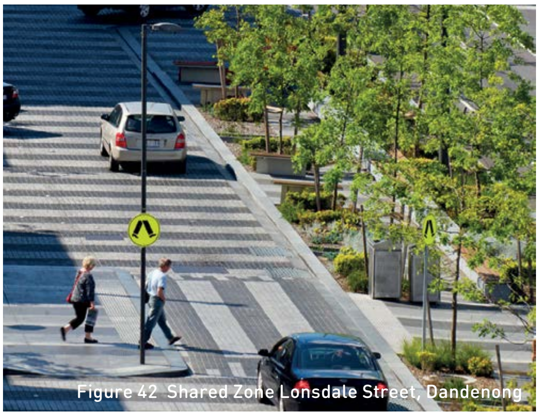


Figure 42 Shared Zone Lonsdale Street, Dandenong

6.8.7 Transitions between shared paths should be safe, continuous and seamless, with direct routes and consistent design elements to assist with legibility.

6.8.8 Ensure paths are safe and useable, with no impediments such as steep ramps, barriers or stairs.

6.8.9 Design requirements and prioritisation of cycling infrastructure is to connect and align with bicycle priority routes, including the State's program for Strategic Cycling Corridors and the Principle Bicycle Network.

6.8.10 Improve way finding and legibility around sites affected by the project, with consideration of new infrastructure and impacts on existing pathways and linkages.

Wayfinding should be intuitive, clear and consistent. Integrate signage and cycling infrastructure in response to local palettes and signage systems, and within the urban design approach for the project as a whole.

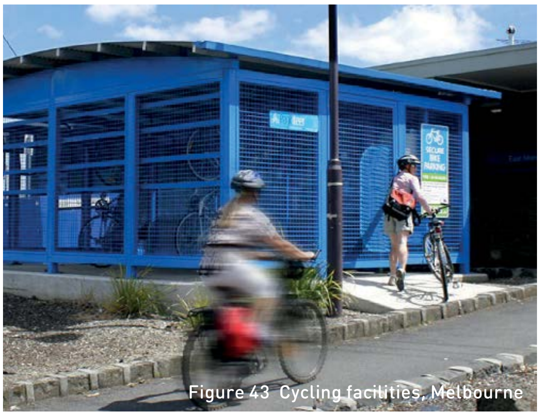


Figure 43 Cycling facilities, Melbourne

6.9 MATERIALS AND FINISHES

6.9.1 A palette of materials, finishes and landscape textures and colours is to be developed as part of the urban design concept. Palettes are to be sensitive to local environments, assist in the broader wayfinding strategy for the corridor and its precincts, and contribute to authentic enhancement of local identity.

6.9.2 Materials and finishes used in the project are to be high quality, durable, robust, easy to maintain and will age well over time.

6.9.3 Care should be given to ensure new materials and finishes are not overly reflective and do not create light pollution in the surrounding areas.

6.9.4 Selection and application of materials and finishes should be done to minimise potential for vandalism including graffiti.

6.9.5 Design for accessibility and functionality for ease of maintenance.

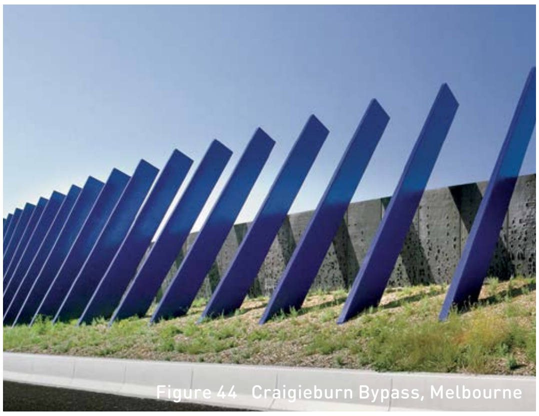


Figure 44 Craigieburn Bypass, Melbourne

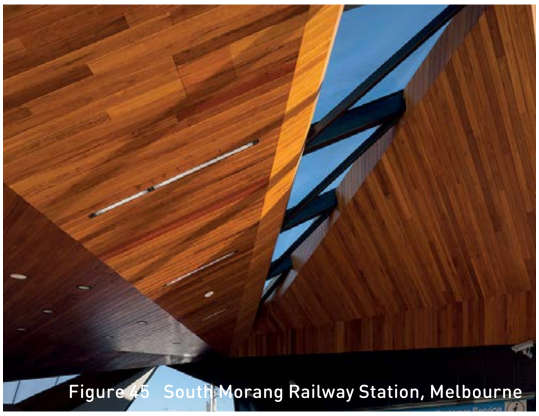


Figure 45 South Morang Railway Station, Melbourne

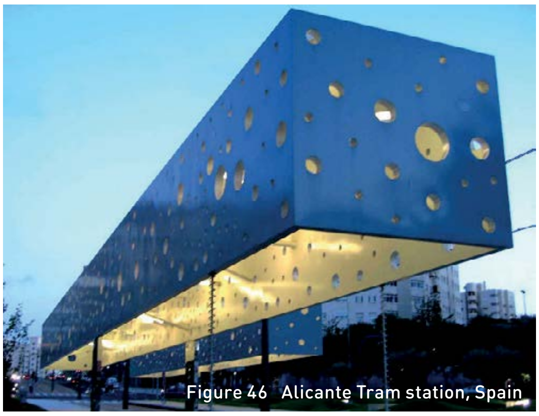


Figure 46 Alicante Tram station, Spain

6.10 NOISE ATTENUATION

6.10.1 Mitigate noise pollution of the surrounding areas in accordance with current State policy.

6.10.2 New noise attenuation elements are to be coordinated and designed to be integrated with consideration to the structures, existing noise attenuation elements, landforms, urban interfaces, urban design concept for precincts and for the project as a whole.

6.10.3 Transparent panels are to be used where noise walls substantially interfere with residents' views or access to daylight.

6.10.4 Design noise barriers to positively address and enhance both the rail side and community side of barriers. Noise walls should be designed with careful consideration to form, texture and colour on both sides of the walls with equal value.

6.10.5 Overshadowing of residential properties and open space, waterways and valuable habitat by noise barriers or other noise attenuation structures is to be minimised.

6.10.6 Design to minimise potential for vandalism to noise attenuation treatments, through materials selection, detail and positioning.

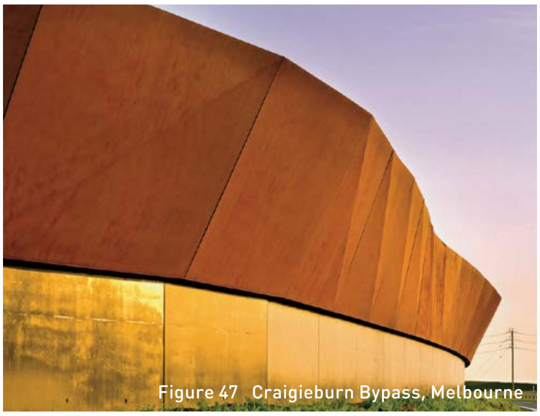


Figure 47 Craigieburn Bypass, Melbourne

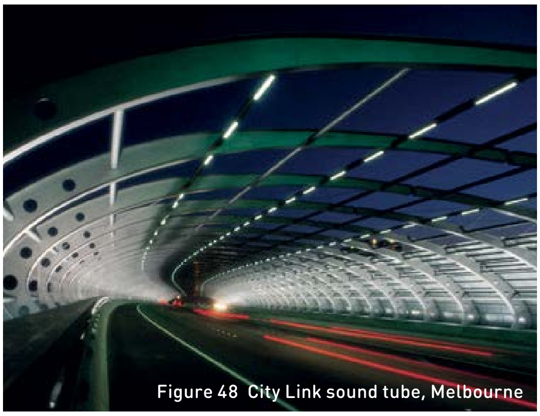


Figure 48 City Link sound tube, Melbourne

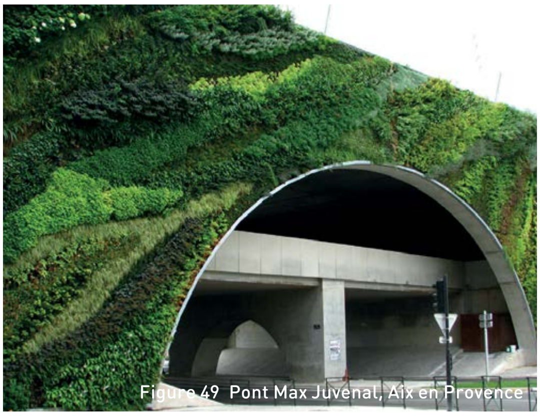


Figure 49 Pont Max Juvenal, Aix en Provence

6.11 LIGHTING

6.11.1 Functional lighting for the project is to integrate with surrounding areas and be appropriate to the surrounding land uses. It should be considered relative to personal safety and access around the new transport infrastructure. Use energy efficient, vandal proof light fixtures that offer ease of access for maintenance, and are integrated design elements.

6.11.2 Feature lighting should be used in the project, to enhance navigation and the user experience, as an integrated part of the urban design concept. This lighting type should be coordinated with other design elements to create a cohesive identity for the project.

6.11.3 Any lighting employed in the project should be designed sensitively to the surrounding environment and oriented to minimise any light pollution. Design is to use highly directional lighting wherever possible to avoid lighting spill into surrounding neighbourhoods, parks and urban environments.

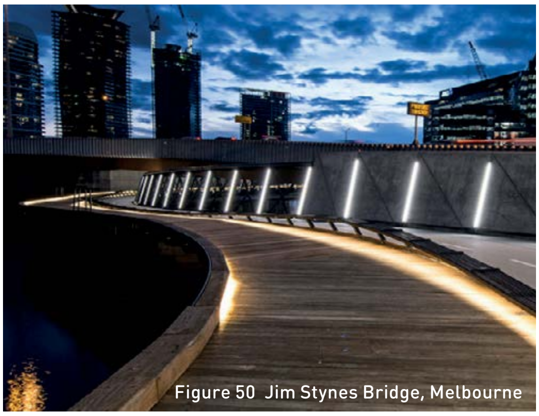


Figure 50 Jim Stynes Bridge, Melbourne

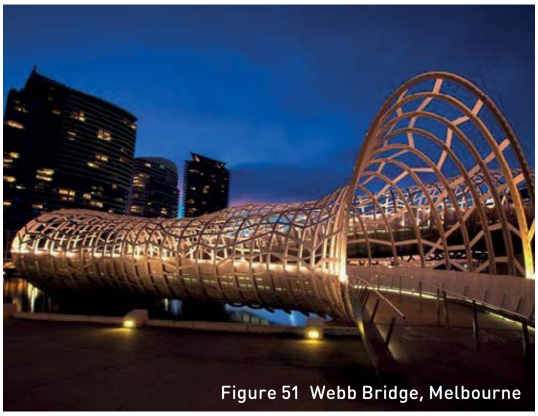


Figure 51 Webb Bridge, Melbourne

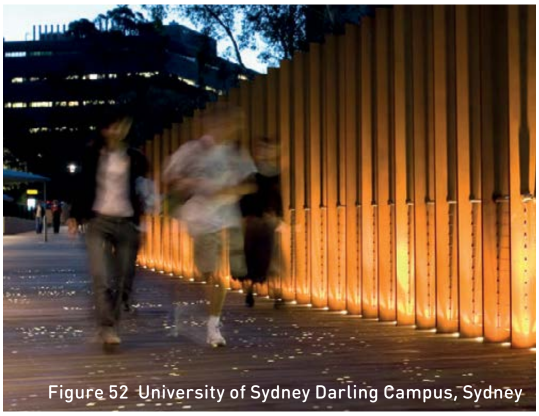


Figure 52 University of Sydney Darling Campus, Sydney

6.12 INTEGRATED PUBLIC ART WORKS

6.12.1 Consider the incorporation of public artworks in key locations.

6.12.2 Where public artworks are proposed, articulate and employ a process for selection, commissioning, implementation and on-going maintenance that ensures the works are of a high quality, responsive to the character of the urban setting, and will endure conceptually and physically.

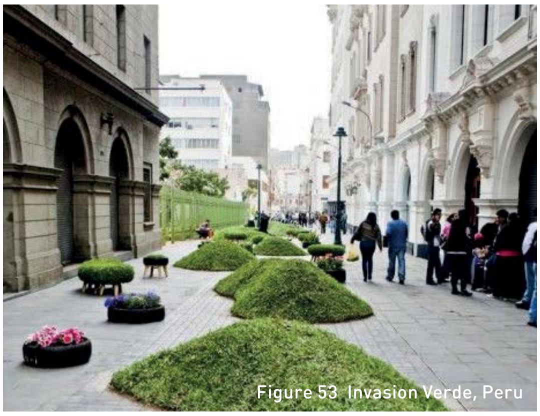


Figure 53 Invasion Verde, Peru

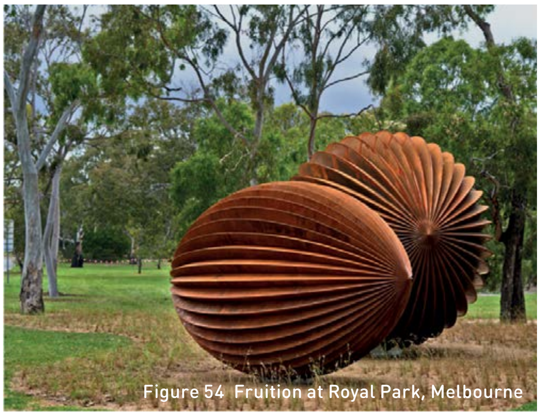


Figure 54 Fruition at Royal Park, Melbourne

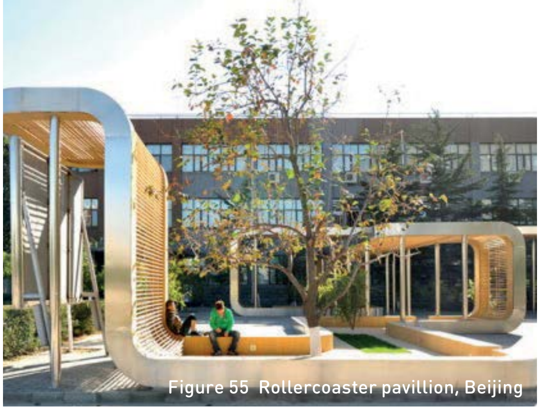


Figure 55 Rollercoaster pavillion, Beijing

6.13 INTEGRATED DEVELOPMENT OPPORTUNITIES

6.13.1 Integrated Development Opportunities (IDOs) should be designed to make a positive contribution to the local area and act as a catalyst for urban renewal, and encourage development / land use innovation where possible.

6.13.2 Built form and land uses should have regard to the policy context of the site and location, including broader Metropolitan Melbourne policy objectives which encourage higher density development in and around activity centres.

6.13.3 Consider a mix of land uses that contribute positively to the area and the local economy, including the potential to accommodate commercial uses and community and social uses where possible to meet other government outcomes.

6.13.4 Continue active frontages and retail functions in commercial areas where appropriate.

6.13.5 Integrate development with train station functions, to ensure physical connectivity and protection of visual and noise amenity is maintained, with station requirements (including access and other operational requirements) to take precedence.

6.13.6 Where possible, provide a diversity in housing options, including a mix of dwelling types and investigate opportunities for social and affordable housing.

6.13.7 Consider opportunities to maximise car parking efficiencies by potentially integrating commuter car parking into the development outcome for the site through the application of shared arrangements and/or off-peak utilization of car park spaces.

6.13.8 Where possible, any temporary vacant IDO sites should be developed with an appropriate interim land use and corresponding landscape design, so they make a positive contribution to the local area over the entire project lifecycle.

Figure 56 Rouse Hill

Figure 57 Breslauer Platz, Cologne

Figure 58 Nunawading Station

7. IMPLEMENTATION

7.1 EMBEDDING DESIGN QUALITY

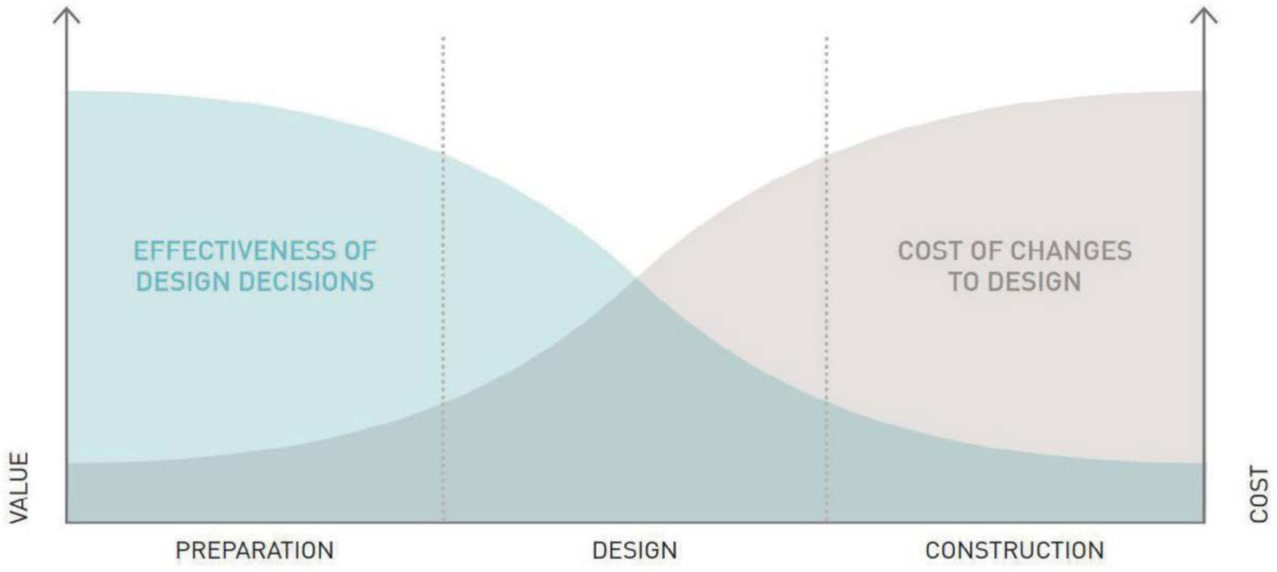
High quality, well-integrated design is critical to the success of a major infrastructure project. Establishing from the outset a vision for a site that considers the long-term possibilities for a place and community at a broader scale than just that of the initial transport project investment may act as a catalyst and unlock transformative urban integration and urban renewal opportunities.

The following excerpt is taken from the Office of the Victorian Government Architect's procurement guidance document Government as 'Smart Client' and illustrates the importance of introducing key design initiatives early in the design process to support quality design outcomes.

The diagram indicates that during a project's initial scoping and design phase it is possible to have a very substantial impact on design quality. As the project continues it is dominated by the rigours of the procurement process and the contractual and commercial demands of construction. The ability to impact and improve design quality becomes more difficult and expensive as the project progresses. When key design initiatives are put in place at the early stages of a project then there is a greater opportunity for good design to be realized.

Factors which can have a significant impact on design outcomes include:

- development of a Vision Statement
- quality of the Brief
- adequacy of the Budget
- adequacy of the Program
- need for Design Review
- experience and quality of the Management of the process
- the skill of the Design Team.



7.2 DESIGN QUALITY INITIATIVES

To support high quality and integrated urban design outcomes the LXRA is putting in place design initiatives and processes that will ensure design quality is embedded at the earliest stages of project's lifecycle from inception and continue for the life of a project. The establishment of design advice and design review mechanisms to support the implementation of the Urban Design Framework is critical to the success of the program.

7.2.1 Urban Design Advisory Panel

The Urban Design Advisory Panel (UDAP) will be comprised of members/stakeholders working within government who have particular professional expertise in architecture, urban design, strategic planning, transport planning and landscape architecture. A representative of The Office of the Victorian Government Architect (OVGA) will be the Chair of the UDAP and will drive high quality outcomes and integrated design for the LCRP, Mernda Rail Extension Project (MREP) and other future projects as allocated.

The UDAP will guide and advise on:

a. Integrated design for projects delivered by the LXRA, including vision statements, urban context/ design reports and reference designs/project proposals to inform project scope and budget decisions;

b. Development of project briefs and urban design performance requirements;

c. Development of bidders' concept designs;

c. Concept design development during a competitive tender process

d. Evaluation of bidders' design proposals;

e. Design and integration of development opportunities.

The UDAP will facilitate workshops and design advisory processes throughout the project lifecycle, and before major decisions are made. This design-led approach is intended to be positive and iterative, promoting site responsive designs that are consistent with the aspirations of each of the activity centres and adjacent neighbourhoods, and add value to the outcomes of the program.

7.2.2 Victorian Design Review Panel

The Victorian Design Review Panel (VDRP), which is managed by the OVGA, provides independent and authoritative advice to government and statutory decision makers across Victoria about the design of significant development proposals.

For LXRA, the VDRP can be made available to review project designs at key milestones, as an independent peer review. The VDRP could also be brought in at key stages of the procurement process to support the design review process and provide independent advice. The UDAP will be responsible for ensuring that any recommendations from the VDRP are considered in the design process.

The VDRP consists of highly experienced built environment professionals, who provide expert design review of significant projects at key stages of the design and development process. Architects, urban designers, landscape architects and planners,as well as specialists in sustainability, accessibility, health, place making and masterplanning, contribute to the VDRP.

The VDRP reviews projects that are significant because of their site, context or complexity, or because they will be establishing a precedent for new development in a place. The VDRP can review all scales of development from masterplans, major infrastructure, buildings, streets and public spaces.

8. FIGURE SOURCES

Figure	Title	Page	Source
1	*Level crossings proposed for renewal*	*3*	*LXRA*
2-6	*Regional Rail Link, Melbourne*	*15*	*LXRA*
7	*Olympic Sculpture Park, Seattle*	*16*	*www.shank13.wordpress.com/2012/08/20/landscape-traditions-olympic-sculpture-park-final-paper*
8	*Craigieburn Bypass, Melbourne*	*16*	*www.yasammekan.com1000*
9	*Shared Zone Lonsdale Street, Dandenong*	*16*	*www.archdaily.com.br/br/01-156615/projeto-lonsdale-street-dandenong-slash-bkk-architects/52016265e8e44eb cd3000075-lonsdale-street-dandenong-bkk-architects-photo*
10	*Newtown Interchange, Sydney*	*17*	*www.wp.architecture.com.au/nswawards/2013-winners-list-jury-citations/2013-urban-design-entries*
11	*PARK[E]ING, Venice*	*17*	*www.landezine.com/index.php/2013/02/parkeing-by-stradivarie-associated-architects*
12	*Gloucester Reserve WSUD, Melbourne*	*17*	*GHD*
13	*Skyttlebron Railway Bridge, Lund*	*18*	*www.dezeen.com/2014/06/13/skyttlebron-railway-bridge-lund-sweden-metro-arkitekter-zig-zags-onto-the-platforms*
14	*North Melbourne Station, North Melbourne*	*18*	*www.steel.com.au/showcase/projects/north-melbourne-station*
15	*Hoxton Station, London*	*19*	*www.westonwilliamson.com/projects/transport/victoria-station-upgrade*
16	*Hyllie Station, Sweden*	*19*	*www.stylepark.coom*
17	*Yeouido Cycle Tunnel, Seoul*	*20*	*www.lokaldesign.com/index.php?/infrastructure/yeouido-specialized-project*
18	*McCormick Tribune Campus Centre, Chicago*	*20*	*www. iolet0012.egloos.com/m/619521*
19	*Eastlink, Melbourne*	*20*	*VicRoads*
20	*Eastlink Pedestrian Bridge, Melbourne*	*21*	*www.eastlink.com.au*

Figure	Title	Page	Source
21	*Footbridge Over the Railways, Villetaneuse*	*21*	*www.lasthomedecors.com*
22	*Folly for a Flyover temporary cinema, London*	*21*	*www.assemblestudio.co.uk/?page_id=5*
23	*Cheonggyecheon River Restoration, Seoul*	*22*	*www.paulalogy.com/korea-travelogue-day-2-myeongdong-cathedralbukchon-hanok-village-jump-and-cheonggyecheon*
24	*Freeway Park on the I-5, Seattle*	*22*	*www.greatbuildings.com/buildings/Freeway_Park.html*
25	*Pacific Highway, Banora Point*	*22*	*www.rms.nsw.gov.au/projects/planning-principles/centre-for-urban-design/achievements/pacific-highway-banora-point.html*
26	*Nicholson Street Mall, Footscray*	*24*	*www.v1.german-architects.com/en/projects/6099_nicholson_street_mall/all/indexAZ*
27	*City Square, Melbourne CBD*	*24*	*www.v1.german-architects.com/en/projects/6099_nicholson_street_mall/all/indexAZ*
28	*Burnside skate park, Oregon*	*24*	*www.skateparkhunter.com/usa/burnside-skatepark/*
29	*MediaCityUK, Salford*	*25*	*www.landezine.com/index.php/2011/08/mediacityuk-landscape-architecture*
30	*A8ernA, Koog aan de Zaan*	*25*	*www.architonic.com/aisht/a8erna-nl-architects/5100103*
31	*Shared Zone Lonsdale Street, Dandenong*	*25*	*www.archdaily.com*
32	*Cranbourne Botanical Gardens, Melbourne*	*26*	*www.johngrimshawsgardendiary.blogspot.com.au/2012/12/the-australian-garden-rbg-cranbourne.html*
33	*Buffalo Bayou Promenade, Houston*	*26*	*www.batonrougelakes.org/planner*
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35	*West Footscray Station, Melbourne*	*27*	*www.anlc.com.au/completed-projects/west-footscray-train-station*
36	*BP Bridge, Chicago*	*27*	*www.worldofbuildings.com/bldg_profile.php?bldg_id=1240*
37	*Auckland Waterfront, Auckland*	*28*	*www.landezine.com/index.php/2012/09/north-wharf-promenade-by-taylor-cullity-lethlean/taylor-cullity-lethlean_aucklandwaterfront_08*
38	*Edinburgh Gardens Rain Garden, Melbourne*	*28*	*GHD*
39	*Clifton Hill Railway Duplication, Melbourne*	*28*	*www. architectureau.com/articles/clifton-hill-railway-project/*

Figure	Title	Page	Source
40	*Monash Freeway Rock Climbing Wall, Burnley*	*29*	*www. thenorthsider.com.au*
41	*Eastern Freeway bike path, Melbourne*	*29*	*GHD*
42	*Shared Zone Lonsdale Street, Dandenong*	*29*	*www.archdaily.com*
43	*Cycling facilities, Melbourne*	*30*	*www.bicyclenetwork.com.au*
44	*Craigieburn Bypass, Melbourne*	*31*	*www.archivitamins.com/wp-content/uploads/2013/09/055.jpg*
45	*South Morang Railway Station, Melbourne*	*31*	*www.worldarchitecturenews.com/wanmobile/mobile/article/20716*
46	*Alicante Tram station, Spain*	*31*	*www.homedit.com/fun-and-modern-train-station-in-alicante-spain*
47	*Craigieburn Bypass, Melbourne*	*32*	*www.tcl.net.au/projects/infrastructure/craigieburn-bypass*
48	*City Link sound tube, Melbourne*	*32*	*www.roadtraffic-technology.com/projects/melbourne_citylink*
49	*Pont Max Juvenal, Aix en Provence*	*32*	*www.urbantimes.co/2011/12/patrick-blanc-converting-our-city-walls-into-vertical-gardens*
50	*Jim Stynes Bridge, Melbourne*	*33*	*www.coolon.com.au/architectural-led-product/electro*
51	*Webb Bridge, Melbourne*	*33*	*www.tcsworldtravel.com/expedition/australia-and-new-zealand/2016/march/gallery*
52	*University of Sydney Darling Campus, Sydney*	*33*	*www.tcl.net.au/projects/education/university-of-sydney*
53	*Invasion Verde, Peru*	*34*	*www.verdeinnovativo.wordpress.com/2011/02/27/invasion-verde-genaro-alva-claudia-ampuero-denise-ampuero-gloria-rojas*
54	*Fruition at Royal Park, Melbourne*	*34*	*www.mcclellandgallery.com/index.php?page=matthew-harding*
55	*Rollercoaster pavillion, Beijing*	*34*	*www.dezeen.com/2011/11/08/rollercoaster-by-interval-architects*
56	*Rouse Hill*	*35*	*mosmanplanning.net*
57	*Breslauer Platz, Cologne*	*35*	*www.illumni.co*
58	*Nunawading Station*	*35*	*www. commercial.prebuilt.com.au*

ATTACHMENT V DRAFT PLANNING SCHEME AMENDMENTS

SECTION

Planning and Environment Act 1987
Kingston Planning Scheme Amendment C155

Explanatory report

Instruction sheet

Schedule to Clause 52.03 Specific sites and exclusions

Schedule to Clause 81.01 Table of Documents Incorporated in this scheme

Incorporated document

SECTION

Planning and Environment Act 1987
Kingston Planning Scheme Amendment C156

Explanatory report

Instruction sheet

Schedule to Clause 52.03 Specific sites and exclusions

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Planning and Environment Act 1987

KINGSTON PLANNING SCHEME

AMENDMENT C155

EXPLANATORY REPORT

Who is the planning authority?

This amendment has been prepared by the Minister for Planning, who is the planning authority for this amendment.

The amendment has been made at the request of the Level Crossing Removal Authority (**LXRA**), an administrative office established under the *Public Administration Act 2004* in the Department of Economic Development, Jobs, Transport and Resources (**DEDJTR**).

Land affected by the amendment

The amendment applies to the land (**Land**) required for the Edithvale Road, Edithvale Level Crossing Removal Project (**Project**), as shown on the maps in the *Edithvale Road, Edithvale Level Crossing Removal Project Incorporated Document, January 2018.*

The Land is generally located in the vicinity of the Edithvale Railway Station, Edithvale and extends north to Aspendale Railway Station and south towards Chelsea Road, Chelsea.

The Land includes the existing rail corridor and surrounding road reserves.

What the amendment does

The amendment inserts the *Edithvale Road, Edithvale Level Crossing Removal Project Incorporated Document, January 2018* (**Incorporated Document**) into the schedules to Clause 52.03 (Specific sites and exclusions) and Clause 81.01 (Documents incorporated in the scheme) of the Kingston Planning Scheme.

Strategic assessment of the amendment

Why is the amendment required?

The amendment is required to facilitate the timely, coordinated and consistent delivery of the Project. The Project is part of the Victorian Government's commitment to remove 50 level crossings on the metropolitan rail network which will increase road, freight and passenger rail and pedestrian safety and improve public transport facilities and efficiency.

Edithvale Road is a major east-west arterial road which forms part of the arterial road network connecting the Nepean Highway, the Mornington Peninsula Freeway, Wells Road and Springvale Road. Edithvale Road is an important thoroughfare within Edithvale, servicing local education, community and recreation facilities, as well as the Edithvale/Seaford Wetlands. It provides an important connection from Edithvale and surrounding suburbs to the nationally significant Dandenong and Monash National Employment and Innovation Clusters, and to locally and regionally significant activity and employment nodes such as the Dandenong Metropolitan Activity Centre, the Springvale Major Activity Centre and the locally important Braeside, Carrum Downs and Seaford Industrial Precincts.

Approximately 12,000 vehicles per day currently use the Edithvale Road level crossing. These volumes are expected to increase. To allow trains to pass the boom gates must

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operate which causes lengthy delays to vehicles, pedestrians, cyclists and bus services attempting to cross the rail line, particularly during morning and evening peak periods.

The Project will facilitate a range of positive social effects including reduced congestion on the local and arterial road networks, increased reliability of the rail network, increased safety on the rail and road network, improved connectivity in the local area and improved access to jobs and services.

The Project will improve local and regional connectivity to and from Edithvale by improving east-west access across the rail corridor in the area, and enhance access to important local areas such as the Edithvale foreshore. The new Edithvale Railway Station will provide for improved access to parking, local shops and public transport for local residents and visitors, with quality architectural, landscaping and urban design outcomes.

The removal of this level crossing will improve safety by eliminating conflict between trains, vehicles, cyclists and pedestrians. Construction of new bicycle and pedestrian shared use paths and pedestrian bridges over the rail line will provide for safer walking and cycling connections in the local area.

The Project will also improve business and regional freight efficiency by reducing congestion and delay for business and road and rail freight travel.

The amendment will allow the use and development of the Land for the purposes of the Project in accordance with the Incorporated Document.

The Project includes the following key components:

- Removal of the level crossing at Edithvale Road, Edithvale where it crosses the Frankston rail line.
- Railway construction and associated works to lower the existing Frankston rail line under Edithvale Road, including, but not limited to, bulk excavation, relocation of existing utilities and installation of new utility infrastructure, earthworks, installation of drainage and retaining walls, replacement of track infrastructure, access tracks, landscaping, vegetation removal and construction of bicycle and pedestrian shared use paths.
- Road construction and associated works including construction of a road bridge over the Frankston rail line at Edithvale Road and associated works including alterations to road access arrangements.
- Development of a new train station, including the provision for the sale of food, drink and other convenience goods and services, decking over the trench, car parking, bicycle facilities and loading and unloading facilities.
- Provision of pedestrian access and shared bicycle use paths, including the construction of pedestrian bridges over the railway line.
- Associated rail infrastructure, including a new substation and tie stations, power upgrades and overhead infrastructure, cabling and signalling.
- Creation and alteration of access to roads.
- Ancillary activities, preparatory and enabling works.

How does the amendment implement the objectives of planning in Victoria?

The amendment implements the objectives of planning in Victoria as set out in section 4 of the *Planning and Environment Act 1987* (**PE Act**) in the following ways:

a) To provide for the fair, orderly, economic and sustainable use, and development of land

The amendment facilitates a Project that will reduce congestion, contribute to a more reliable road and rail system and improve safety and local connectivity for road users, pedestrians and cyclists.

b) To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.

The Incorporated Document requires that the Project be designed and delivered in accordance with the *Edithvale and Bonbeach Level Crossing Removal Project EES Environmental Management Framework* (**EMF**). The EMF is a framework to ensure that the Project will comply with relevant statutory requirements and minimise environmental risks. The EMF sets out the environmental outcomes to be achieved during the design and construction of the Project and will encourage innovation. The EMF sets out accountabilities for managing and monitoring environmental effects and hazards associated with the design and construction of the Project. The EMF will reflect the outcome of the Environment Effects Statement (**EES**) required by the Minister for Planning.

The EMF has been informed by detailed technical studies which have considered environmental risks associated with the design and construction of the Project.

The Project will impact native vegetation on the Land. The design and construction of the Project will minimise impacts to native vegetation and offsets will be provided in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017), except as otherwise agreed by the Secretary to the Department of Environment, Land, Water and Planning (**DELWP**).

c) To ensure pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria

The amendment will facilitate a project that will contribute to the more efficient use of existing infrastructure by improving the reliability and capacity of the passenger and freight rail network, as well as improving the safety and efficiency of the road and rail network.

The Project will eliminate conflict between trains, vehicles, cyclists and pedestrians by lowering the Frankston rail line beneath Edithvale Road to create a grade separated crossing, providing enhanced safety, functionality and usability for all users.

The design of the Project will respond to the local social and built form context and will enhance the living and working environment for nearby communities by improving connectivity between surrounding areas across the rail line.

d) To conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value

There are no sites, or places identified on the National Heritage List, Commonwealth Heritage List, Victorian Heritage Register or the Victorian Heritage Inventory within or immediately adjoining the Land.

The Land also includes land within a Heritage Overlay. The Chelsea Clock Tower, located on Nepean Highway, Chelsea is recognised as locally significant within the Kingston Planning Scheme (HO28). Where works within the overlay would normally require a planning permit, site plans, elevations and other relevant documentation will be prepared to the satisfaction of the Minister of Planning to ensure that the identified heritage values have been appropriately considered and managed.

Aboriginal cultural heritage will be managed in accordance with the approved Cultural Heritage Management Plan (**CHMP**) in accordance with the *Aboriginal Heritage Act 2006* (**AH Act**).

e) To protect public utilities and other assets and enable the orderly provision and coordination of public utilities and other facilities for the benefit of the community

The Incorporated Document provides for a single approval that will ensure orderly and coordinated provision of public transport infrastructure and facilities for the benefit of the community.

The Project will result in improvements to road and rail infrastructure and will ensure that existing utilities are adequately protected, relocated and upgraded where necessary.

f) To balance the present and future interests of all Victorians

The Victorian Government has committed to the removal of 50 level crossings on the metropolitan rail network. Eleven of these level crossings are located along the Frankston rail corridor.

The amendment will facilitate a project that will benefit present and future users of public transport and road infrastructure. The removal of this level crossing will improve road, rail, bicycle and pedestrian links for Victorians living, working and travelling in the vicinity of Edithvale Railway Station and will improve the safety and operational efficiency of the road and rail networks.

The delivery of the Project will be carefully managed to minimise disruption for rail users, local communities and businesses and provides a net positive improvement to the local area, the Frankston rail corridor and the public transport system.

How does the amendment address any environmental, social and economic effects?

The amendment facilitates the Project which has been assessed under the *Environment Effects Act 1978*. As part of this process, the Project and its potential environmental, social and economic effects have been considered. The amendment addresses environmental, social and economic impacts in the following way:

Environmental Management Framework

The Incorporated Document requires the design and construction of the Project to be in accordance with the EMF. The EMF is a framework to ensure that the Project will comply with relevant statutory requirements and minimise environmental risks. The EMF sets out the environmental outcomes to be achieved during the design and construction of the Project and will encourage innovation. The EMF sets out accountabilities for managing and monitoring environmental, social and economic impacts associated with the design and construction of the Project. The EMF will reflect the outcome of the EES required by the Minister for Planning.

The EMF has been informed by detailed technical studies that have considered the following environmental, social and economic impacts:

- Groundwater
- Ecology
- Contamination and Acid Sulfate Soils
- Surface water
- Land Use
- Traffic
- Noise and vibration
- Air quality
- Landscape and visual
- Business
- Social
- Cultural heritage
- Historic heritage

The EMF contains a suite of Environmental Performance Requirements (**EPRs**) that respond to the technical analysis and identified risks and set out the manner in which the impacts will be managed.

Native Vegetation

The Incorporated Document requires details of the removal, destruction or lopping of native vegetation to be prepared, and appropriately offset in accordance with the *Guidelines for* *the removal, destruction or lopping of native vegetation* (DELWP, 2017), except as otherwise agreed by the Secretary to DELWP. This requirement is in addition to the relevant EPRs that address vegetation.

Heritage

The Incorporated Document requires that:

- Where a planning permit would normally be required for buildings and works or subdivision within a Heritage Overlay, site plans and elevations showing the extent of buildings and works must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.
- Where a planning permit would normally be required for the demolition, alteration, or removal of a building within a Heritage Overlay, a full photographic survey of the buildings, comprising photographs of both the exterior and interiors of the buildings and contextual images of the buildings environs and their settings, must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.

The preparation and approval of a CHMP is required for the Project in accordance with the AH Act. Works will be undertaken in accordance with the AH Act and the approved CHMP for the Project.

These requirements are in addition to the relevant EPRs that address heritage.

Road Access

The Incorporated Document requires that any creation or alteration of access to the arterial road network, or subdivision of land adjacent to the arterial road network, be to the satisfaction of the Roads Corporation (VicRoads). These requirements are in addition to the relevant EPRs that address traffic.

Flooding Controls

The Incorporated Document requires that any building and works on the Land affected by the Special Building Overlay be undertaken to the satisfaction of the relevant floodplain management authority.

Does the amendment address relevant bushfire risk?

The Land is not affected by a Bushfire Management Overlay or located within a bushfire prone area.

Does the amendment comply with the requirements of any Minister's Direction applicable to the amendment?

Section 12(2) (a) of the PE Act requires that in preparing a planning scheme amendment, a planning authority must have regard to the Minister's Directions. The following Minister's Directions are relevant to this amendment:

Ministerial Direction - The Form and Content of Planning Schemes

The amendment is consistent with the *Ministerial Direction - The Form and Content of Planning Schemes* under section 7(5) of the PE Act.

Direction No.1 Potentially Contaminated Land

The Incorporated Document requires the design and construction of the Project in accordance with an EMF. The EMF contains EPRs to manage contamination, and to ensure the environmental condition of the Land is suitable for the future intended use. The Project does not propose any sensitive uses for the purpose of Direction No.1.

Direction No. 9 Metropolitan Strategy

The amendment is consistent with *Direction No. 9 Metropolitan Strategy* by:

- Delivering jobs and investment in the local area.

- Facilitating transport improvements to make jobs and community services more accessible.
- Improving local travel options which will increase social and economic participation.
- Facilitating a more efficient and safe road network which benefits all road users.
- Improving the operation of the existing transport network with faster, more reliable and efficient on-road traffic movement and public transport.
- Ensuring the environmental and construction impacts are managed and minimised through the EMF.

In particular, the amendment delivers on *Plan Melbourne 2017-2050* Outcome 3: *Melbourne has an integrated transport system that connects people to jobs and services and goods to market* by specifically delivering on: Policy 3.1.1: *Create a metro-style rail system with 'turn up and go' frequency and reliability*, which includes the delivery of separated road and rail crossings, Policy 3.1.2: *Provide high-quality public transport access to job-rich areas* by enhancing access to activity centres along the Frankston rail corridor, the Dandenong NEIC, locally and regionally important employment nodes, and to wider metropolitan Melbourne, and Policy 3.1.3 *Improve arterial road connections across Melbourne for all road users* by removal of level crossings.

Direction No. 11 Strategic Assessment of Amendments

The amendment has been prepared having regard to *Direction No. 11 Strategic Assessment of Amendments* and *Planning Practice Note 46: Strategic Assessment Guidelines for Planning Scheme Amendments.*

How does the amendment support or implement the State Planning Policy Framework and any adopted State policy?

This amendment supports or implements the following clauses of the State Planning Policy Framework:

Settlement

Clause 11 (Settlement) recognises the role of planning to anticipate and respond to the needs of existing and future communities and, as far as practicable, contribute towards accessibility, economic viability and the integration of land use and transport. Planning should also facilitate sustainable development that takes full advantage of existing settlement patterns and investment in transport.

The amendment is consistent with this policy and implements the clause in the following manner:

- The Project supports the activity centre hierarchy through improved transport choices and is consistent with the policy of orderly development of urban areas. The Project will improve access to local, regional and metropolitan centres via public transport, walking and cycling.
- The Project will improve access to jobs to and within the locality, key employment nodes in Melbourne's southern subregion and throughout metropolitan Melbourne, the Dandenong and Monash National Employment and Innovation Clusters and Melbourne's central city.

Metropolitan Melbourne

Clause 11.06 (Metropolitan Melbourne) recognises that when considering policy objectives for metropolitan Melbourne, planning must consider as relevant: *Plan Melbourne 2017-2050: Metropolitan Planning Strategy* (DELWP, 2017).

The amendment supports and implements the clause in the following manner:

- The Project will improve access to jobs locally and across metropolitan Melbourne and will facilitate high-quality public transport access to job rich areas and enable improved arterial road connections across Melbourne.

- The Project will improve access to public transport, the service and reliability of the public transport system, local travel options for walking and cycling to support 20 minute neighbourhoods and provides for an integrated transport system.
- The Project will support the establishment of a metro-style rail system by delivering a separated road and rail crossing.

Environmental and Landscape Values

Clause 12 (Environmental and Landscape Values) seeks to assist the protection and conservation of Victoria's biodiversity and the health of ecological systems.

The amendment supports and implements the clause in the following manner:

- The Project will be designed and constructed in accordance with the EMF which will include measures to reduce and manage environmental impacts.
- The Incorporated Document requires that the removal, destruction or lopping of native vegetation be detailed in accordance with *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017), except as otherwise agreed by the Secretary to DELWP.
- The Incorporated Document requires native vegetation offsets to be provided in accordance with the guidelines except as otherwise agreed by the Secretary to DELWP.

Environmental Risks

Clause 13 (Environmental Risks) recognises that planning should adopt a best practice environmental management and risk management approach which aims to avoid or minimise environmental degradation and hazards.

The amendment supports and implements the clause in the following manner:

- The Project will be designed and constructed in accordance with an EMF which will include measures to reduce and manage environmental impacts of the Project.
- The Incorporated Document requires that buildings and works on land covered by the Special Building Overlay be undertaken to the satisfaction of the relevant floodplain management authority.
- The Project has undertaken due-diligence specialist reports to consider a variety of environmental matters.

Built Environment and Heritage

Clause 15 (Built Environment and Heritage) requires that planning should ensure all new land use and development appropriate responds to its landscape, valued built form and cultural context, and protect places and sites with significant value.

The amendment supports and implements the clause in the following manner:

- The Project will be designed and delivered with reference to the LXRA Urban Design Framework*: Principals and Objectives, Measures and Qualitative Benchmarks, 2016* and site specific Urban Design Guidelines. The Framework and Guidelines outlines the principles, objective, measures and benchmarks that will be considered during the development of the design of the Project, and seek to ensure that the resulting built form responds to and is cognisant of the local landscape, built form, urban fabric and cultural context.
- The Chelsea Clock Tower (HO28) is recognised as being of local heritage significance within the Kingston Planning Scheme. The Incorporated Document requires that the Project respond to the identified heritage values of the site.
- The Project will be undertaken in accordance with the approved CHMP for the project area and the requirements of the AH Act.

Transport

Clause 18 (Transport) recognises that planning should facilitate greater use of public transport and ensure an integrated and sustainable transport system that provides access to social and economic opportunities, facilitates economic prosperity, contributes to environmental sustainability, coordinates reliable movements of people and goods, and is safe.

The amendment supports and implements the clause in the following manner:

- The Project will enable improved public transport infrastructure and services on the Principal Public Transport Network, improved accessibility to local, regional and metropolitan activity centres, locally, regionally and nationally significant employment corridors and precincts and will contribute to economic development by delivering a more efficient road and rail system.
- This level crossing removal will improve safety by reducing conflicts between vehicles, trains, pedestrians and cyclists.
- The Project provides new shared use paths that will encourage the use of sustainable personal transport, support the development of 20-minute neighbourhoods and improve access to the public transport system.
- The Project will enable safer and more efficient movement of freight to meet local needs and service markets throughout Victoria by removing constraints on the current road network.
- The Project will provide opportunities for a reduction in greenhouse gas emissions through reduced road congestion and the increased facilitation of sustainable transport options.

How does the amendment support or implement the Local Planning Policy Framework, and specifically the Municipal Strategic Statement?

The amendment supports and implements the following clauses of the Kingston Local Planning Policy Framework (LPPF):

- Clause 21.01 Municipal Strategic Statement
- Clause 21.03 Land Use Challenges for the New Millennium
- Clause 21.04 Vision
- Clause 21.06 Retail and Commercial Land Use
- Clause 21.09 Environment, Wetlands and Waterways
- Clause 21.12 Transport, Movement and Access
- Clause 21.13 Heritage

The amendment supports and implements these clauses in the Kingston Planning Scheme as follows:

- The Project will support Edithvale’s role as a Neighbourhood Activity Centre within the City of Kingston by improving connectivity to and from the activity centre and to local education, recreation and community facilities through the provision of improved transport infrastructure and services.
- The Project will strengthen the role of public transport, walking and cycling as a means of accessing the activity centre and improve connectivity between Edithvale and surrounding suburbs to important activity and employment nodes in Melbourne’s southern subregions.
- The Project will improve reliability on the Frankston rail line, reduce congestion on the road network, increase safety on the rail, road, bicycle and pedestrian network and improve access to jobs and services.

- The Incorporated Document requires that the design and construction of the Project be in accordance with the EMF which will provide an overarching framework and specific measures to manage environmental, social and economic impacts.
- The Incorporated Document forming part of the amendment includes conditions requiring site plans and elevations, and/or a full photographic survey, be submitted to the satisfaction of the Minister for Planning where a planning permit would normally be required under a Heritage Overlay.

Does the amendment make proper use of the Victoria Planning Provisions?

The amendment makes proper use of the Victorian Planning Provisions, specifically Clause 52.03 and Clause 81.01 of the Kingston Planning Scheme to facilitate the Project.

The purpose of Clause 52.03 is to provide in extraordinary circumstances specific controls designed to achieve a particular land use and development outcome.

The use of this provision in this case is appropriate because the Project is of genuine State significance and the Incorporated Document proposed by the amendment will allow the Project to be developed and delivered in a coordinated, consistent and timely manner under a single planning control and will remove the need for the Project to seek multiple and separate planning permits. The site specific controls in this amendment are set out in the Incorporated Document and allow the use and development of the Land for the purposes of the Project in accordance with the conditions set out in the Incorporated Document.

How does the amendment address the views of any relevant agency?

The views of relevant agencies and stakeholders have been considered through an extensive consultation framework as part of the EES process. The views of the following agencies and authorities have been considered:

- Aboriginal Victoria
- DEDJTR
- DELWP
- Department of the Environment and Energy (Commonwealth)
- Environment Protection Agency
- Frankston City Council
- Heritage Victoria
- Kingston City Council
- Melbourne Water
- Metro Trains Melbourne
- Office of the Victorian Government Architect
- Public Transport Victoria
- Southern Rural Water
- Transport for Victoria
- VicRoads
- VicTrack

Does the amendment address relevant requirements of the *Transport Integration Act 2010*?

The amendment facilitates a project that is consistent with the vision statement in the *Transport Integration Act 2010* (**TI Act**) and addresses the key transport system objectives and decision-making principles in the TI Act, in the following ways:

Division 2 – System objectives

- *Social and economic inclusion*: The Project will support social and economic inclusion by improving the reliability of the rail network and increasing capacity of the road network in a key location, thereby expanding opportunities for access to social and economic opportunities, particularly in the surrounding key employment areas.
- *Economic prosperity*: The Project will support economic prosperity by creating jobs and facilitating easier access to employment opportunities in Melbourne's southern subregion and beyond. The Project will modernise and improve existing transport infrastructure which will achieve greater operational efficiencies for Victoria's rail and road networks.
- *Environmental sustainability*: The Project will improve the operational efficiency of the road network which will reduce environmental impacts caused by traffic congestion. Additionally, improvements in transport infrastructure will promote the efficient use of public transport in the overall transport system and it will support the development of the rail network as a sustainable transport option for all Victorians. The Project will be designed and constructed to achieve a design and as-built 'Excellent' 4 Star Green Star rating for the new station and a minimum 'Excellent' (65) Infrastructure Sustainability (IS) rating.
- *Integration of transport and land use*: The Project will be delivered within the existing rail corridor and nearby road reserves and maximizes integration with the existing road network while minimizing impacts to proximate land uses. The Project is part of a wider program expected to contribute to a more efficient and reliable transport system which will encourage increased use of a sustainable mode of transport and facilitate better access to, and greater mobility within, local communities. The amendment will ensure the Project is delivered in a timely manner to support current and future requirements of the transport system and demands of the southern subregion of metropolitan Melbourne.
- *Efficiency, coordination and reliability*: The Project is part of a wider level crossing removal program that will facilitate network-wide efficient, coordinated and reliable movements of persons and vehicles.
- *Safety and health and wellbeing*: The Project will minimise conflict between trains, vehicles, cyclists and pedestrians and will improve road, rail and pedestrian safety. The new Edithvale Railway Station will be designed and constructed to enhance safety, functionality and usability.

Division 3 – Decision-making principles

- *Principle of integration decision making*: The Project has been the subject of a coordinated and public process that has incorporated the views of relevant agencies, statutory authorities, and local government.
- *Principle of triple bottom line assessment*: The economic, environmental and social costs and benefits of the Project have been considered. The investigations and assessments undertaken for the Project satisfy the principles of triple bottom-line assessment.
- *Principle of equity*: The Project will improve the overall operation of the transport system in Melbourne, including access to and from key activity and employment nodes within Melbourne's southern subregion, and will cater for the needs of existing and future businesses and communities. These rail services are available to all persons, and they provide transport opportunities to those who may not have alternative options such as ownership of a private vehicle.
- *Principle of the transport system user perspective*: The Project will facilitate improvements to the transport system which will improve the public transport experience for users.
- *Precautionary principle*: The precautionary principle was adopted during the development of the Project through specialist investigations due diligence evaluations to avoid serious or irreversible damage to the environment.

- *Principle of stakeholder engagement and community participation*: The Project is supported by a communications strategy which included consultation with local communities, transport system users and other key stakeholders.
- *Principle of transparency*: The Project is supported by a communications strategy which included consultation with local communities, transport system users and relevant agencies during the preparation of the amendment. Consultation will continue throughout the lifetime of the Project to provide transparency.

Resource and administrative costs

What impact will the new planning provisions have on the resource and administrative costs of the responsible authority?

The implementation of the new planning provisions will have minimal impact on the resource and administrative costs of the responsible authority.

Where you may inspect this amendment

The amendment can be inspected free of charge at the DELWP website at www.delwp.vic.gov.au/public-inspection.

Planning and Environment Act 1987

KINGSTON PLANNING SCHEME

AMENDMENT C155

INSTRUCTION SHEET

The planning authority for this amendment is the Minister for Planning.

The Kingston Planning Scheme is amended as follows:

Planning Scheme Ordinance

The Planning Scheme Ordinance is amended as follows:

1. In Particular Provisions – Clause 52.03, replace the Schedule with a new Schedule in the form of the attached document.

2. In Incorporated Documents – Clause 81.01, replace the Schedule with a new Schedule in the form of the attached document.

End of document

07/12/2017
~~GC71~~
Proposed C156

SCHEDULE TO CLAUSE 52.03 SPECIFIC SITES AND EXCLUSIONS

1.0 Specific sites and exclusions

07/12/2017
~~GC71~~
Proposed C156

Address of land	Title of incorporated document
North - west corner of Main Road and McMillan Street, Oakleigh South described in Certificates of Title: Volume 8069 Folio 008 Volume 8952 Folio 684 Volume 8952 Folio 685 Volume 8952 Folio 686 Volume 8952 Folio 687 Volume 8952 Folio 688 Volume 8795 Folio 387	Existing Provision Document 1
477 - 481 Warrigal Road, Moorabbin (part) Certificate of Title Volume 9630 Folio 075 (part) Plan of Subdivision 305551M (part) and associated storage units, 21 32, 41, 46, 48, 49, 52, 63 - 67 fronting Warrigal Road Title Volume 10059 Folios 563 – 574	Existing Provision Document 2
88 Beach Road, Mentone	Existing Provision Document 3
South east corner of Centre Dandenong Road and Boundary Roads, Braeside, known as part of Redwood Gardens Industrial Estate	Existing Provision Document 4
No. 1 Rhode Island, Patterson Lakes	Existing Provision Document 5
No. 2 Rhode Island, Patterson Lakes	Existing Provision Document 6
Capital Golf Course – Centre Dandenong Road, Old Dandenong Road, Madden Road and Ross Street, Heatherton. Part Crown Allotments 1,2 and 3, Section 15 Parish of Mordialloc	Existing Provision Document 7
Kingston Heath Golf Course - Kingston Road, Heatherton, Lot 2 on LP. 92000, Parish of Mordialloc	Existing Provision Document 8
462-508 Heatherton Road, Springvale South Certificate of Title Volume 9249 Folio 658	Existing Provision Document 9
The Caulfield Dandenong Rail Upgrade Project land as shown on the maps in the incorporated document.	Caulfield Dandenong Rail Upgrade Project, Incorporated Document, April 2016
Tootal Road, Dingley (known as Lot 1 Grange Road, and 370-440 Old Dandenong Road, Dingley Village) as described in the following certificates of title: ▪ Volume 8077, Folio 174 (Lot 1 of PS 29928). ▪ Volume 8163 Folio 419 (Lot 1 of PS33174). ▪ Volume 8523 Folio 416 (Lot 1 of	Hawthorn Football Club – Function Centre and Signage Controls, Tootal Road, Dingley Village, May 2016

PS 65354). ▪ Volume 8523 Folio 416 (Lot 2 of PS 65354). ▪ Volume 2983 Folio 481 (Lot 1 of TP 561896E). ▪ Volume 8248 Folio 226 (Lot 1 of PS 46359). ▪ Northern portion of Volume 8713 Folio 097 (Lot 1 PS 79066). ▪ Northern portion of Volume 10316 Folio 734 (Lot 4 of PS 404673U). ▪ Northern portion of Volume 8452 Folio 805 (Lot 1 of PS 61906).	
Land required for the Cheltenham Level Crossing Removal Project as shown on the project area maps in the incorporated document.	Cheltenham Level Crossing Removal Project Incorporated Document, July 2017
Land required for the Carrum Level Crossing Removal Project as shown on the project area maps in the incorporated document.	Carrum Level Crossing Removal Project Incorporated Document, December 2017
Land required for the Station Street/Bondi Road, Bonbeach Level Crossing Removal Project as shown on the project area maps in in the Incorporated Document.	Station Street/Bondi Road, Bonbeach Level Crossing Removal Project Incorporated Document, January 2018

07/12/2017
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Proposed C156

SCHEDULE TO CLAUSE 81.01 TABLE OF DOCUMENTS INCORPORATED IN THIS SCHEME

1.0 Incorporated documents

07/12/2017
~~GC71~~
Proposed C156

Name of document	Introduced by:
Australian Standard AS2021-2015, Acoustics – Aircraft Noise Intrusion – Building Siting and Construction, Standards Australia Limited, 2015	VC107
Aspendale Gardens Incorporated Plan, 1 November 1999	NPS1
Carrum Level Crossing Removal Project Incorporated Document, December 2017	GC71
Caulfield Dandenong Rail Upgrade Project, Incorporated Document, April 2016	GC37
Cheltenham Level Crossing Removal Project Incorporated Document, July 2017	GC70
Clayton South Medium Density Housing Development Guidelines, May 2003	C10
Documents Incorporated Under Clause 52.03 – Specific Sites and Exclusions	
▪ Existing Provision Document 1	NPS1
▪ Existing Provision Document 2	NPS1
▪ Existing Provision Document 3	NPS1
▪ Existing Provision Document 4	NPS1
▪ Existing Provision Document 5	NPS1
▪ Existing Provision Document 6	NPS1
▪ Existing Provision Document 7	NPS1
▪ Existing Provision Document 8	NPS1
▪ Existing Provision Document 9	NPS1
Draft Guidelines for the assessment of heritage planning applications, August 2000	C46(Part 2)
Endeavour Cove Comprehensive Development Plan, December 1999	NPS1
Hawthorn Football Club – Function Centre and Signage Controls, Tootal Road, Dingley Village, May 2016	C161
Heatherton Christian College, Master Plan, June 2007	C94
Kingston Lodge Concept Plan, 2006	C71
Kingston Lodge Precinct Development Plan, 2 December 1997	NPS1
Kingston Neighbourhood Character Guidelines, August 2007	C77
Siting and Design Guidelines for Structures on the Victorian Coast, May 1998	C2
Station Street/Bondi Road, Bonbeach Level Crossing Removal Project Incorporated Document, January 2018	C156
Wells Road, Aspendale Gardens Landscape Concept Plan for Outline Development Plan, September 1999	NPS1
Westfield Shoppingtown Southland Concept Plan, November 1994	NPS1

Edithvale Road, Edithvale
Level Crossing Removal Project

Incorporated Document

January 2018

Incorporated document pursuant to section 6(2)(j) of the *Planning and Environment Act 1987*

1.0 INTRODUCTION

This document is an incorporated document in the Kingston Planning Scheme (**planning scheme**) and is made pursuant to section 6(2)(j) of the *Planning and Environment Act 1987*.

The land identified in Clause 3.0 of this document may be used and developed in accordance with the specific controls in Clause 4.0 of this document.

The control in this document prevails over any contrary or inconsistent provision in the planning scheme.

2.0 PURPOSE

The purpose of this incorporated document is to allow the use and development of land for the purposes of the Station Street/Bondi Road, Bonbeach Level Crossing Removal Project, including a railway, railway station, and associated upgrades to the road and rail network (**Project**).

3.0 LAND

The control in this document applies to the land required for the Project as shown in the Project Area Maps forming part of this document (**Land**).

4.0 CONTROL

4.1 EXEMPTION FROM PLANNING SCHEME REQUIREMENTS

Despite any provision to the contrary or any inconsistent provision in the planning scheme, no planning permit is required for, and no planning provision in the planning scheme operates to prohibit, or restrict or regulate the use or development of the Land for the purposes of the Project.

The Project includes, but is not limited to, the following:

a) Removal of the level crossing at Station Street/Bondi Road, Bonbeach where it crosses the Frankston rail line.

b) Railway construction and associated works to lower the existing Frankston rail line under Station Street/Bondi Road, including, but not limited to, bulk excavation, relocation of existing utilities and installation of new utility infrastructure, earthworks, installation of drainage and retaining walls, replacement of track infrastructure, access tracks, landscaping, vegetation removal and construction of bicycle and pedestrian shared use paths.

c) Road construction and associated works including construction of a road bridge over the Frankston rail line at Station Street/Bondi Road and associated works including alterations to road access arrangements.

d) Development of a new railway station, including provision for the sale of food, drink and other convenience goods and services, decking over the trench, car parking, bicycle facilities and loading and unloading facilities.

e) Provision of pedestrian access and shared bicycle use paths, including the

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construction of pedestrian bridges over the railway line.

f) Associated rail infrastructure, including power upgrades and overhead infrastructure, cabling and signaling.

g) Creation and alteration of access to roads.

h) Ancillary activities, preparatory and enabling works, including, but not limited to:

    i) Use and development of lay down areas for construction purposes.

    ii) Stockpiling of excavation material.

    iii) Use and development of temporary site workshops and storage, administration and amenities buildings, access and vehicle parking.

    iv) Removal, destruction or lopping of trees and vegetation, including native vegetation and dead native vegetation.

    v) Demolition and removal of buildings, structures and works.

    vi) Relocation, modification and upgrade of services and utilities.

    vii) Construction of fences, temporary site barriers and site security.

    viii) Construction or carrying out works to create or alter roads, car parking areas, bunds, mounds, landscaping, excavate land, salvage artefacts and alter drainage.

    ix) Earthworks including cutting, stockpiling and removal of spoil, and the formation of drainage works.

    x) Display of construction, directional or identification signs.

    xi) Subdivision and consolidation of land.

4.2 CONDITIONS

The use and development permitted by this document must be undertaken in accordance with the following conditions:

Environmental Management Framework

4.2.1 The Project must be designed and constructed in accordance with the Edithvale and Bonbeach Level Crossing Removal Project EES Environmental Management Framework (**EMF**).

4.2.2 The EMF may be amended from time to time, to the satisfaction of the Minister for Planning.

Native Vegetation

4.2.2 Details of the proposed removal, destruction or lopping of native vegetation necessary for the construction of the Project must be prepared in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017) to the satisfaction of the Secretary to the Department of Environment, Land, Water and Planning (**DELWP**), except as otherwise agreed by the Secretary to DELWP.

4.2.3 Native vegetation offsets must be provided in accordance with the *Guidelines*

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4.2.4 Where, but for this incorporated document, a planning permit would be required for buildings and works or subdivision within a Heritage Overlay, site plans and elevations showing the extent of buildings and works must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.

4.2.5 Where, but for this incorporated document, a planning permit would be required for the demolition, alteration, or removal of a building within a Heritage Overlay, a full photographic survey of the buildings, comprising photographs of both the exterior and interiors of the buildings and contextual images of the buildings environs and their settings, must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.

Flood Management

4.2.6 Where, but for this incorporated document, a planning permit would be required for buildings and works on land within the Special Building Overlay, the buildings and works must be undertaken to the satisfaction of the relevant floodplain management authority.

Road Access

4.2.7 The creation and alteration of access to a road in a Road Zone Category 1 must be to the satisfaction of the Roads Corporation.

4.2.8 Subdivision of land adjacent to a road in a Road Zone Category 1 must be to the satisfaction of the Roads Corporation.

Other Conditions

4.2.9 Unless otherwise stated, the plans and other documents listed in Clause 4.2 must be approved prior to the commencement of works. Plans and other documents may be prepared and approved for separate components or stages of the Project but each plan or other document must be approved before commencement of works for that component or stage.

4.2.10 The plans and other documents may be amended from time to time to the satisfaction of the Minister for Planning or the relevant approving authority. In deciding whether a plan or other document is satisfactory or whether to consent to an amendment to a plan or other document, the Minister for Planning or the relevant approving authority may seek the views of council and any other relevant authority.

4.2.11 The use and development of the Land must be undertaken generally in accordance with the approved plans and documents.

4.3 PREPARATORY AND OTHER WORKS

The following buildings and works and uses may commence on the Land prior to the approval of the plans and other documents listed in Clause 4.2:

a) Preparatory works for the Project including but not limited to:

    i) Works, including vegetation removal, where but for this incorporated document, a planning permit would not be required under the

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provisions of the planning scheme.

   ii) Investigation, testing and preparatory works to determine the suitability of land, and property condition surveys.
   iii) Construction access points and working platforms.
   iv) Site establishment works including temporary site fencing and hoarding, site offices, and hardstand and laydown areas.
   v) Construction, protection, modification, removal or relocation of utility services, rail signaling, overhead and associated infrastructure.
   vi) Establishment of environment and traffic controls, including designation of 'no-go' zones.
   vii) Establishment of temporary car parking.
   viii) Demolition to the minimum extent necessary, to enable preparatory works.
   ix) Salvage and relocation of aboriginal cultural heritage material and other management actions in accordance with the relevant Cultural Heritage Management Plan approved under the *Aboriginal Heritage Act 2006* or otherwise in compliance with that Act.

b) The removal, destruction or lopping of native vegetation to the minimum extent necessary to enable preparatory works to the satisfaction of the Minister for Planning. Any native vegetation removed to enable preparatory works forms part of the total extent of native vegetation removal necessary for the construction of the Project and native vegetation offsets must be provided in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017) except as otherwise agreed by the Secretary to DELWP.

5.0 EXPIRY

The controls in this document expire if any of the following circumstances apply:

- The development allowed by the controls, including preparatory works, is not started by 1 December 2020.
- The development allowed by the controls is not completed by 1 December 2025.

The Minister for Planning may extend these periods if a request is made in writing before the expiry date or within three months afterwards.

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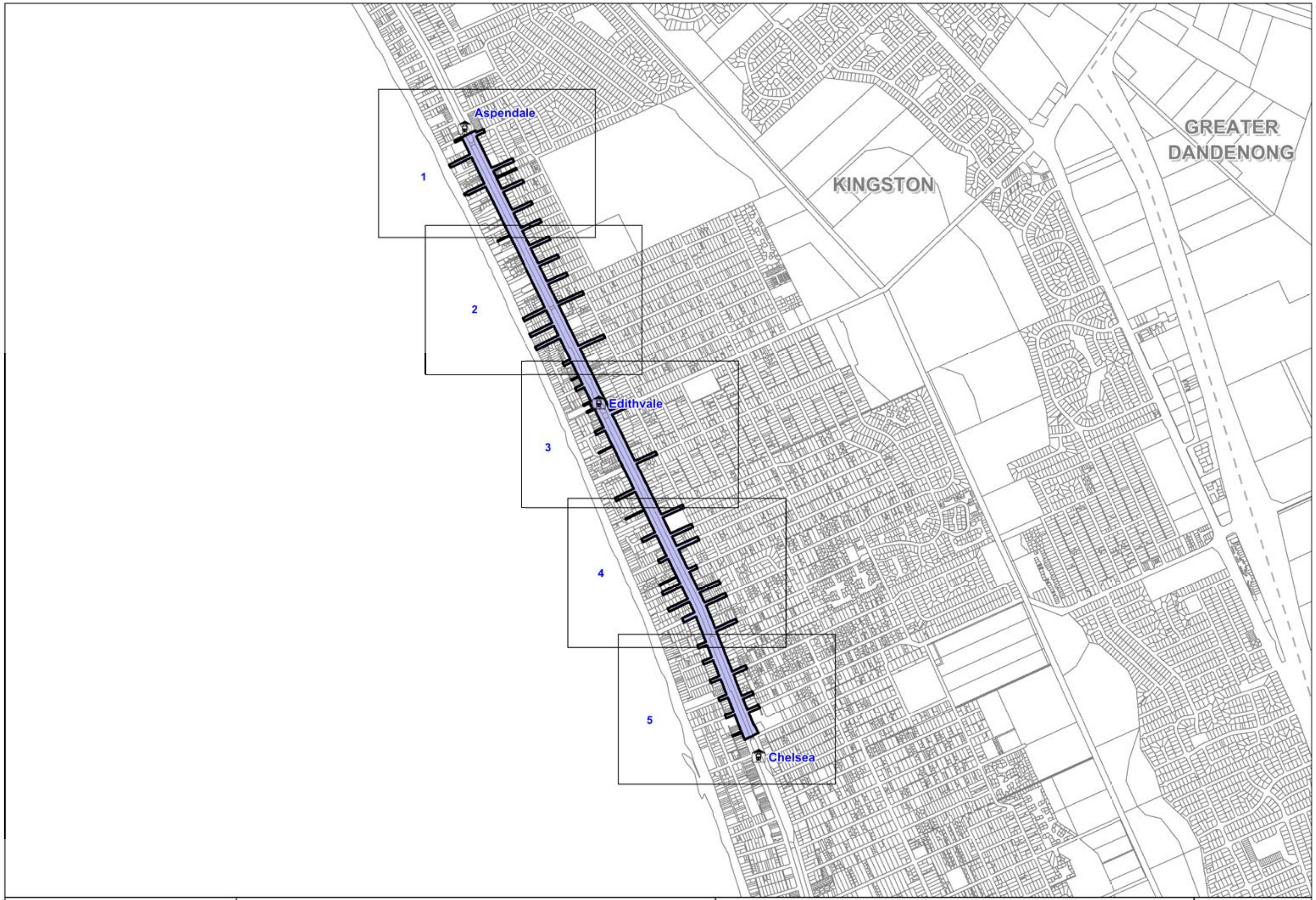

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INDEX

Date: 12/01/2018

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LEGEND

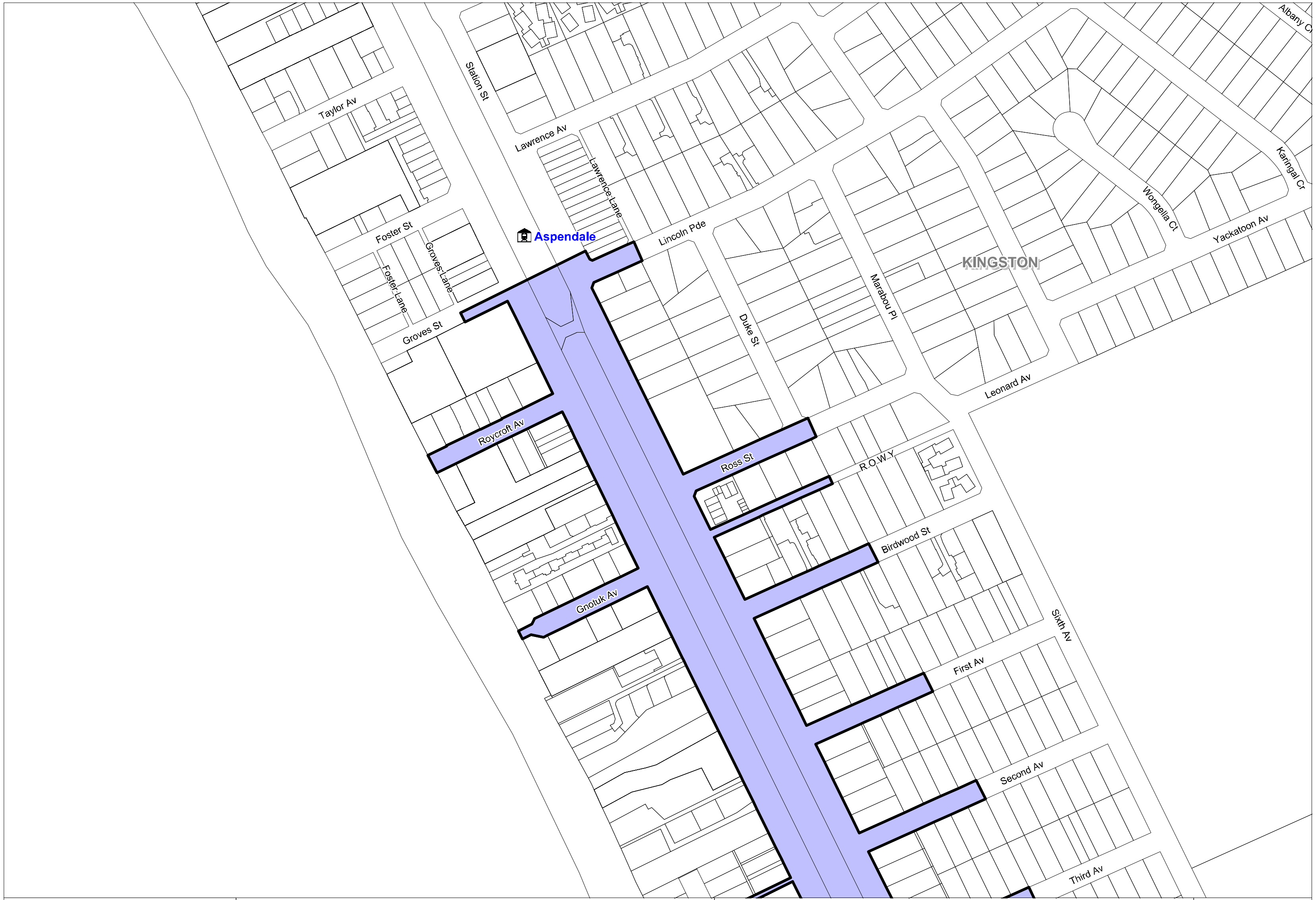
▭ Edithvale Road, Edithvale EES Project Area

Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

Disclaimer: LXRA gives no warranty as to the condition, quality, accuracy or fitness of the data. The recipient acknowledges that the data cannot be guaranteed to be up-to-date or error free



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Sheet 1 of 5

Date: 12/01/2018

LEGEND

Edithvale Road, Edithvale EES Project Area

Railway Station

VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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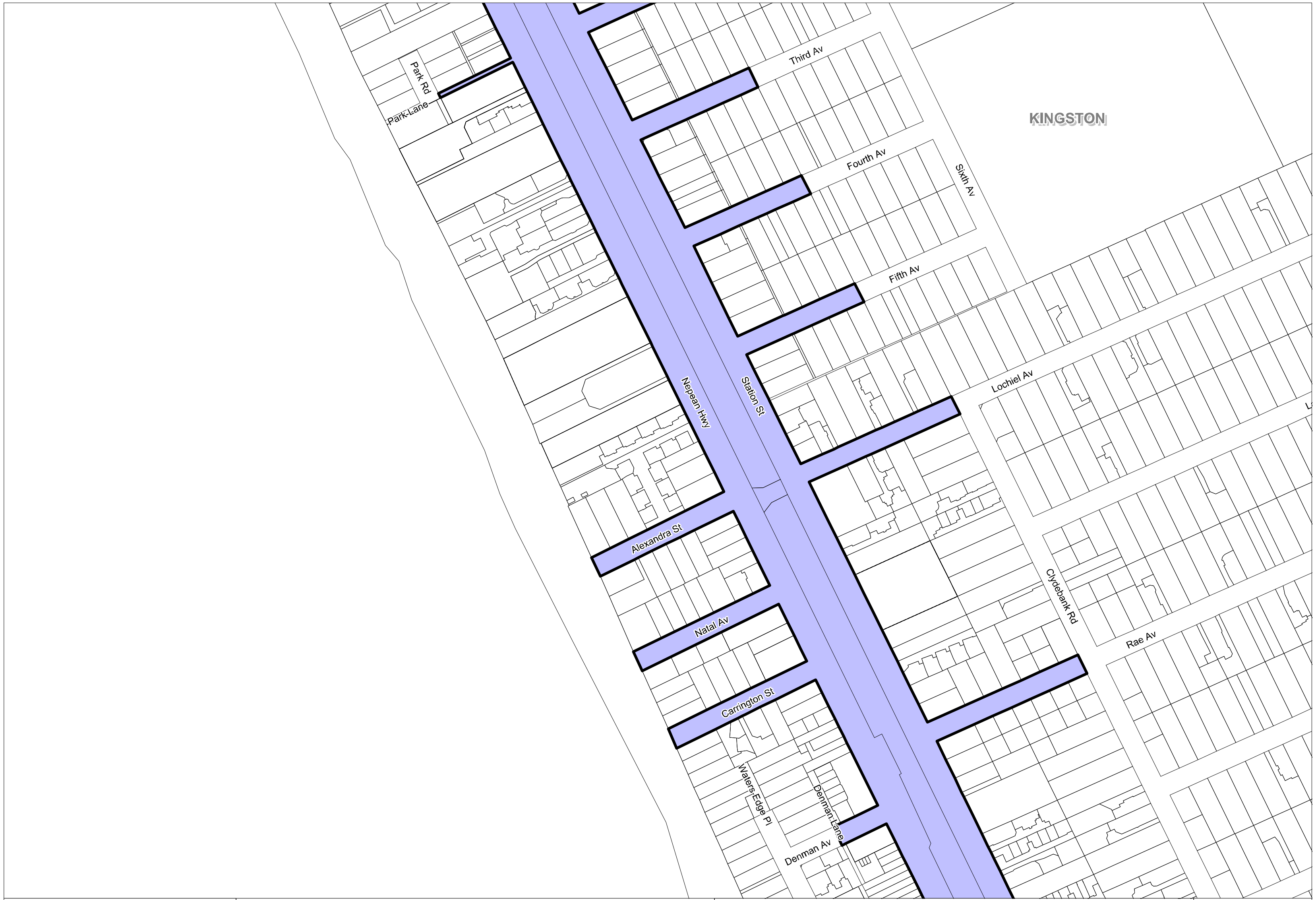

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Sheet 2 of 5
Date: 12/01/2018

LEGEND

▨ Edithvale Road, Edithvale EES Project Area

Railway Station

☐ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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LEVEL CROSSING REMOVAL AUTHORITY

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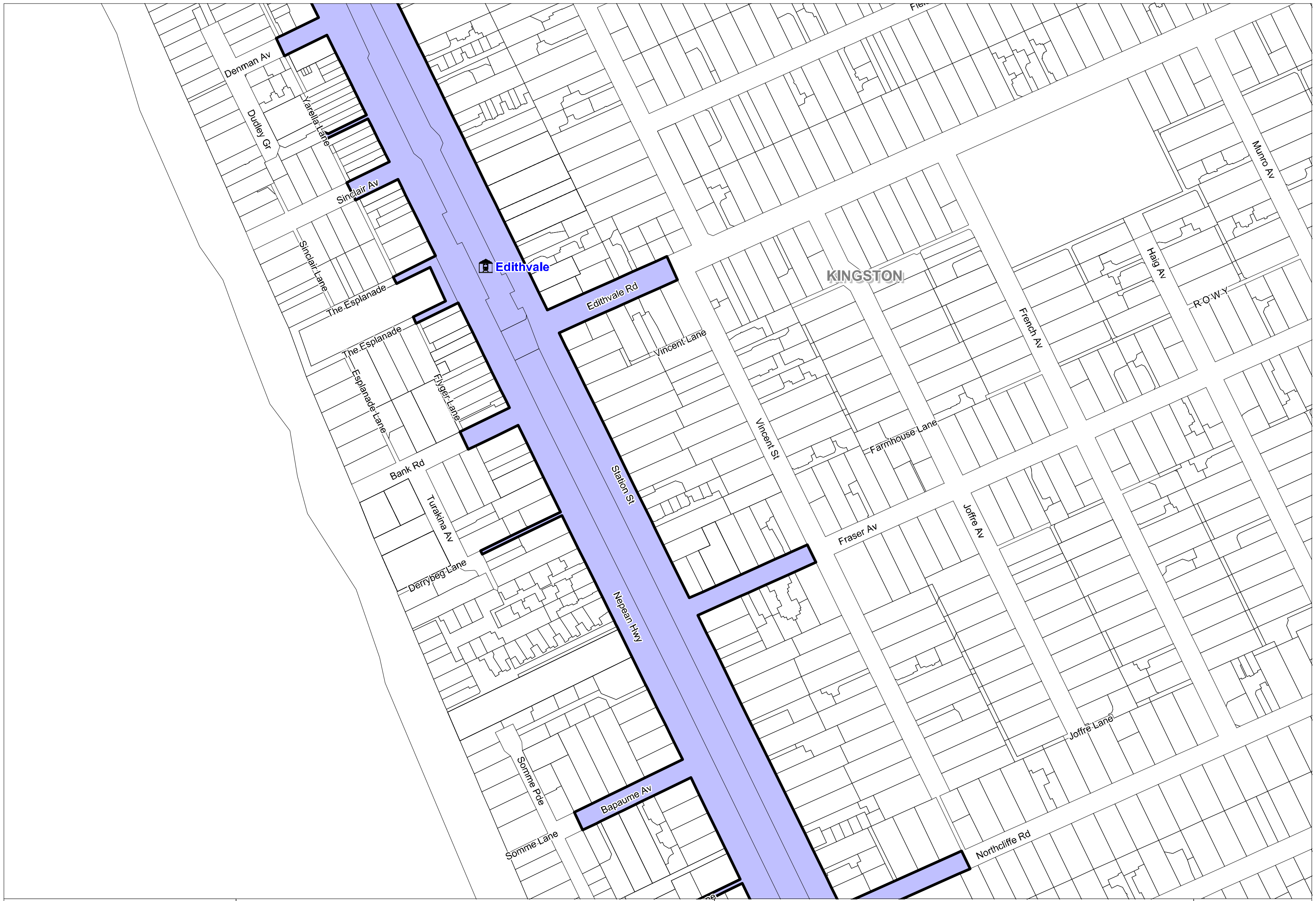

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Sheet 3 of 5

Date: 12/01/2018

LEGEND

▭	Edithvale Road, Edithvale EES Project Area
🚉	Railway Station
▭	VicMap Cadastre

LEVEL CROSSING REMOVAL AUTHORITY

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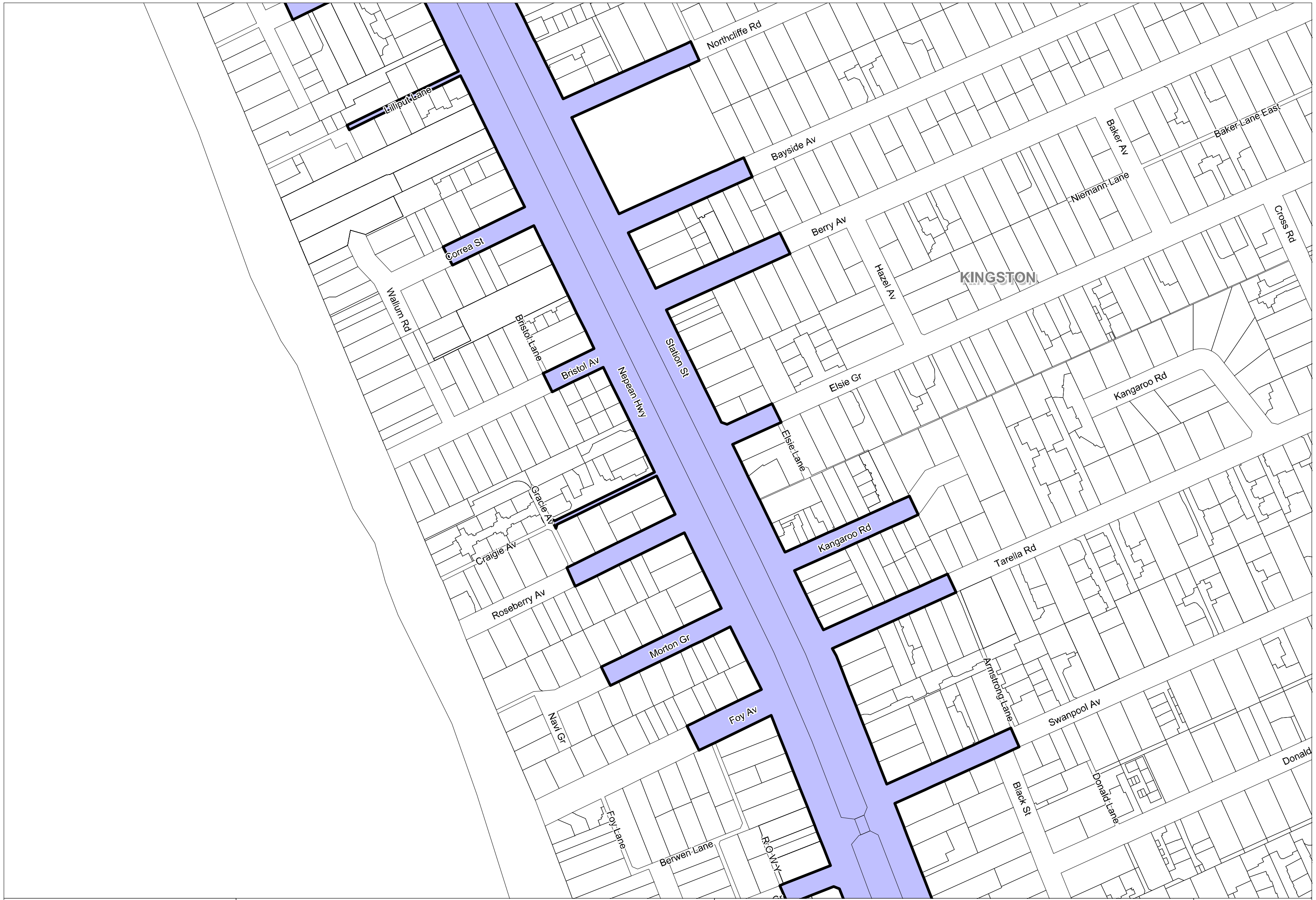

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Sheet 4 of 5

Date: 12/01/2018

LEGEND

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🏠 Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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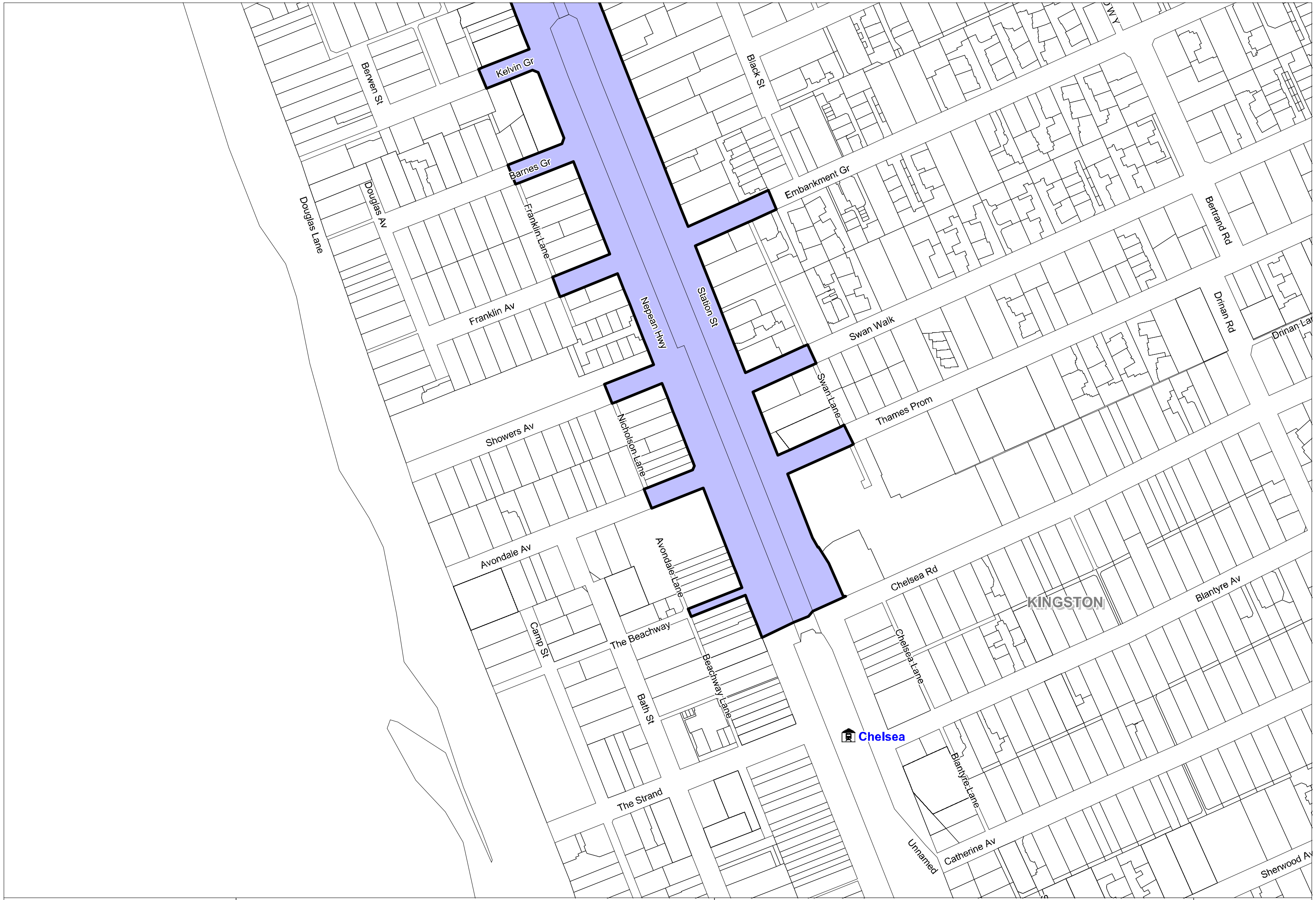

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Sheet 5 of 5 | Date: 12/01/2018

LEGEND

▭ Edithvale Road, Edithvale EES Project Area

Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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Planning and Environment Act 1987

KINGSTON PLANNING SCHEME

AMENDMENT C156

EXPLANATORY REPORT

Who is the planning authority?

This amendment has been prepared by the Minister for Planning, who is the planning authority for this amendment.

The amendment has been made at the request of the Level Crossing Removal Authority (**LXRA**), an administrative office established under the *Public Administration Act 2004* in the Department of Economic Development, Jobs, Transport and Resources (**DEDJTR**).

Land affected by the amendment

The amendment applies to the land (**Land**) required for the Station Street/Bondi Road, Bonbeach Level Crossing Removal Project (**Project**), as shown on the maps in the *Station Street/Bondi Road, Bonbeach Level Crossing Removal Project Incorporated Document, January 2018*.

The Land is generally located in the vicinity of the Bonbeach Railway Station, Bonbeach and extends north to Chelsea Road, Chelsea and south towards the north bank of the Patterson River, Bonbeach.

The Land includes the existing rail corridor, surrounding road reserves and public land.

What the amendment does

The amendment inserts the *Station Street/Bondi Road, Bonbeach Level Crossing Removal Project Incorporated Document, January 2018* (**Incorporated Document**) into the schedules to Clause 52.03 (Specific sites and exclusions) and Clause 81.01 (Documents incorporated in the scheme) of the Kingston Planning Scheme.

Strategic assessment of the amendment

Why is the amendment required?

The amendment is required to facilitate the timely, coordinated and consistent delivery of the Project. The Project is part of the Victorian Government's commitment to remove 50 level crossings on the metropolitan rail network which will increase road, freight and passenger rail and pedestrian safety and improve public transport facilities and efficiency.

Bondi Road is an important local road which connects the predominately residential areas of Bonbeach to Station Street and the Nepean Highway. In particular, the Nepean Highway is an arterial road that provides north-south connectivity to the locally and regionally significant Frankston Metropolitan Activity Centre, the Chelsea Major Activity Centre and the Edithvale and Carrum Neighbourhood Activity Centres. These arterial and local roads also provide connection to important employment nodes in Melbourne's southern subregion, including the Dandenong and Monash National Employment and Innovation Clusters, the Dandenong Metropolitan Activity Centre, the Springvale Major Activity Centre and the locally important Braeside, Carrum Downs and Seaford Industrial Precincts.

Approximately 4,400 vehicles per day currently use the Bondi Road level crossing. These volumes are expected to increase. To allow trains to pass the boom gates must operate which causes lengthy delays to vehicles, pedestrians, cyclists and bus services attempting to cross the rail line, particularly during morning and evening peak periods.

The Project will facilitate a range of positive social effects, including reduced congestion on the local and arterial road networks, increased reliability of the rail network, increased safety on the rail and road network, improved connectivity in the local area and improved access to jobs and services.

The Project will improve local connectivity within Bonbeach by improving east-west access across the rail corridor in this area, and enhance access to important local areas such as the Bonbeach foreshore. The new Bonbeach Railway Station will provide for improved access to parking, local shops and public transport for local residents and visitors, with quality architectural, landscaping and urban design outcomes.

The removal of this level crossing will improve safety by eliminating conflict between trains, vehicles, cyclists and pedestrians. Construction of new bicycle and pedestrian shared use paths and pedestrian bridges over the rail line will provide for safer walking and cycling connections in the local area.

The Project will also improve business and regional freight efficiency by reducing congestion and delay for business and road and rail freight travel.

The amendment will allow the use and development of the Land for the purposes of the Project in accordance with the Incorporated Document.

The Project includes the following key components:

- Removal of the level crossing at Station Street/Bondi Road, Bonbeach where it crosses the Frankston rail line.
- Railway construction and associated works to lower the existing Frankston rail line under Station Street/Bondi Road, including, but not limited to, bulk excavation, relocation of existing utilities and installation of new utility infrastructure, earthworks, installation of drainage and retaining walls, replacement of track infrastructure, access tracks, landscaping, vegetation removal and construction of bicycle and pedestrian shared use paths.
- Road construction and associated works, including construction of a road bridge over the Frankston rail line at Station Street/Bondi Road and associated works including alterations to road access arrangements.
- Development of a new train station, including the provision for the sale of food, drink and other convenience goods and services, decking over the trench, car parking, bicycle facilities and loading and unloading facilities.
- Provision of pedestrian access and shared bicycle use paths, including the construction of pedestrian bridges over the railway line.
- Associated rail infrastructure, including power upgrades and overhead infrastructure, cabling and signalling.
- Creation and alteration of access to roads.
- Ancillary activities, preparatory and enabling works.

How does the amendment implement the objectives of planning in Victoria?

The amendment implements the objectives of planning in Victoria as set out in section 4 of the *Planning and Environment Act 1987* (**PE Act**) in the following ways:

a) To provide for the fair, orderly, economic and sustainable use, and development of land

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The amendment facilitates a Project that will reduce congestion, contribute to a more reliable road and rail system and improve safety and local connectivity for road users, pedestrians and cyclists.

b) To provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity.

The Incorporated Document requires that the Project be designed and delivered in accordance with the *Edithvale and Bonbeach Level Crossing Removal Project EES Environmental Management Framework* (**EMF**). The EMF establishes a framework to ensure that the Project will comply with relevant statutory requirements and minimise environmental risks. The EMF will set out the environmental outcomes to be achieved during the design and construction of the Project and will encourage innovation. The EMF sets out accountabilities for managing and monitoring environmental effects and hazards associated with the design and construction of the Project. The EMF will reflect the outcome of the Environment Effects Statement (**EES**) required by the Minister for Planning.

The EMF has been informed by detailed technical studies which have considered environmental risks associated with the design and construction of the Project.

The Project will impact native vegetation on the Land. The design and construction of the Project will minimise impacts to native vegetation and offsets will be provided in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017), except as otherwise agreed by the Secretary to the Department of Environment, Land, Water and Planning (**DELWP**).

c) To ensure pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria

The amendment will facilitate a Project that will contribute to the more efficient use of existing infrastructure by improving the reliability and capacity of the passenger and freight rail network, as well as improving the safety and efficiency of the road and rail network.

The Project will eliminate conflict between trains, vehicles, cyclists and pedestrians by lowering the Frankston rail line beneath Station Street/Bondi Road, Bonbeach to create a grade separated crossing, providing enhanced safety, functionality and usability for all users.

The design of the Project works will respond to the local surrounds and natural assets and will enhance the living and working environment for nearby communities by improving connectivity between surrounding areas across the rail line.

d) To conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value

There are no sites, or places identified on the National Heritage List, Commonwealth Heritage List, Victorian Heritage Register or the Victorian Heritage Inventory within or immediately adjoining the Land.

The Land also includes land within a Heritage Overlay. The Chelsea Station and Signal Box, Chelsea is recognised as locally significant within the Kingston Planning Scheme (HO31). Where works within the overlay would normally require a planning permit, site plans, elevations and other documentation will be prepared to the satisfaction of the Minister of Planning to ensure that the identified heritage values have been appropriately considered and managed.

Aboriginal cultural heritage will be managed in accordance with the approved Cultural Heritage Management Plan (**CHMP**) in accordance with the *Aboriginal Heritage Act 2006* (**AH Act**).

e) To protect public utilities and other assets and enable the orderly provision and coordination of public utilities and other facilities for the benefit of the community

The Incorporated Document provides for a single approval that will ensure orderly and coordinated provision of public transport infrastructure and facilities for the benefit of the community.

The Project will result in improvements to road and rail infrastructure and will ensure that existing utilities are adequately protected, relocated and upgraded where necessary.

f) To balance the present and future interests of all Victorians

The Victorian Government has committed to the removal of 50 level crossings on the metropolitan rail network. Eleven of these level crossings are located along the Frankston rail corridor.

The amendment will facilitate a project that will benefit present and future users of public transport and road infrastructure. The removal of this level crossing will improve road, rail, bicycle and pedestrian links for Victorians living, working and travelling in the vicinity of the Project and will improve the safety and operational efficiency of the road and rail networks.

The delivery of the Project will be carefully managed to minimise disruption for rail users, local communities and businesses and provides a net positive improvement to the local area, the Frankston rail corridor and the public transport system.

How does the amendment address any environmental, social and economic effects?

The amendment facilitates the Project which has been assessed under the *Environment Effects Act 1978*. As part of this process, the potential environmental, social and economic effects of the Project have been considered. The amendment addresses environmental, social and economic impacts in the following way:

Environmental Management Framework

The Incorporated Document requires the design and construction of the Project to be in accordance with the EMF. The EMF is a framework to ensure that the Project will comply with relevant statutory requirements and minimise environmental risks. The EMF sets out the environmental outcomes to be achieved during the design and construction of the Project and will encourage innovation. The EMF sets out accountabilities for managing and monitoring environmental effects and hazards associated with the design and construction of the Project. The EMF will reflect the outcome of the EES required by the Minister for Planning.

The EMF has been informed by detailed technical studies that have considered the following environmental, social and economic impacts:

- Groundwater
- Ecology
- Contamination and Acid Sulfate Soils
- Surface water
- Land Use
- Traffic
- Noise and vibration
- Air quality
- Landscape and visual
- Business
- Social
- Cultural heritage
- Historic heritage

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The EMF contains a suite of Environmental Performance Requirements (**EPRs**) that respond to the technical analysis and identified risks and set out the manner in which the impacts will be managed.

Native Vegetation

The Incorporated Document requires details of the removal, destruction or lopping of native vegetation to be prepared, and appropriately offset in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017), except as otherwise agreed by the Secretary to DELWP. This requirement is in addition to the relevant EPRs that address vegetation.

Heritage

The Incorporated Document requires that:

- Where a planning permit would normally be required for buildings and works or subdivision within a Heritage Overlay, site plans and elevations showing the extent of buildings and works must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.
- Where a planning permit would normally be required for the demolition, alteration, or removal of a building within a Heritage Overlay, a full photographic survey of the buildings, comprising photographs of both the exterior and interiors of the buildings and contextual images of the buildings environs and their settings, must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.

The preparation and approval of a CHMP is required for the Project in accordance with the AH Act. Works will be undertaken in accordance with the AH Act and the approved CHMP for the Project.

These requirements are in addition to the relevant EPRs that address heritage.

Road Access

The Incorporated Document requires that any creation or alteration of access to the arterial road network, or subdivision of land adjacent to the arterial road network, be to the satisfaction of the Roads Corporation (VicRoads). These requirements are in addition to the relevant EPRs that address traffic.

Does the amendment address relevant bushfire risk?

The Project Area is not affected by a Bushfire Management Overlay or located within a bushfire prone area.

Does the amendment comply with the requirements of any Minister's Direction applicable to the amendment?

Section 12(2) (a) of the PE Act requires that in preparing a planning scheme amendment, a planning authority must have regard to the Minister's Directions. The following Minister's Directions are relevant to this amendment:

Ministerial Direction - The Form and Content of Planning Schemes

The amendment is consistent with the *Ministerial Direction - The Form and Content of Planning Schemes* under section 7(5) of the PE Act.

Direction No.1 Potentially Contaminated Land

The Incorporated Document requires the design and construction of the Project in accordance with an EMF. The EMF contains EPRs to manage contamination, and to ensure the environmental condition of the Land is suitable for the future intended use. The Project does not propose any sensitive uses for the purpose of Direction No.1.

Direction No. 9 Metropolitan Strategy

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The amendment is consistent with *Direction No. 9 Metropolitan Strategy* by:

- Delivering jobs and investment in the local area.
- Facilitating transport improvements to make jobs and community services more accessible.
- Improving local travel options which will increase social and economic participation.
- Facilitating a more efficient and safe road network which benefits all road users.
- Improving the operation of the existing transport network with faster, more reliable and efficient on-road traffic movement and public transport.
- Ensuring the environmental and construction impacts are managed and minimised through the EMF.

In particular, the amendment delivers on *Plan Melbourne 2017-2050* Outcome 3: *Melbourne has an integrated transport system that connects people to jobs and services and goods to market* by specifically delivering on: Policy 3.1.1: *Create a metro-style rail system with 'turn up and go' frequency and reliability*, which includes the delivery of separated road and rail crossings, Policy 3.1.2: *Provide high-quality public transport access to job-rich areas* by enhancing access to activity centres along the Frankston rail corridor, locally and regionally important employment nodes and to wider metropolitan Melbourne, and Policy 3.1.3 *Improve arterial road connections across Melbourne for all road users* by removal of level crossings.

Direction No. 11 Strategic Assessment of Amendments

The amendment has been prepared having regard to *Direction No. 11 Strategic Assessment of Amendments* and *Planning Practice Note 46: Strategic Assessment Guidelines for Planning Scheme Amendments.*

How does the amendment support or implement the State Planning Policy Framework and any adopted State policy?

This amendment supports or implements the following clauses of the State Planning Policy Framework:

Settlement

Clause 11 (Settlement) recognises the role of planning to anticipate and respond to the needs of existing and future communities and, as far as practicable, contribute towards accessibility, economic viability and the integration of land use and transport. Planning should also facilitate sustainable development that takes full advantage of existing settlement patterns and investment in transport.

The amendment is consistent with this policy and implements the clause in the following manner:

- The Project supports the activity centre hierarchy through improved transport choices and is consistent with the policy of orderly development of urban areas. The Project will improve access to local, regional and metropolitan centres via public transport, walking and cycling.
- The Project will improve access to jobs to and within the locality, key employment nodes in Melbourne's southern subregion and throughout metropolitan Melbourne, the Dandenong and Monash National Employment and Innovation Clusters and the Central City.

Metropolitan Melbourne

Clause 11.06 (Metropolitan Melbourne) recognises that when considering policy objectives for metropolitan Melbourne, planning must consider as relevant: *Plan Melbourne 2017-2050: Metropolitan Planning Strategy* (DELWP, 2017).

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The amendment supports and implements the clause in the following manner:

- The Project will improve access to jobs locally and across metropolitan Melbourne and facilitate high-quality public transport access to job rich areas.
- The Project will improve access to public transport, the service and reliability of the public transport system, local travel options for walking and cycling to support 20 minute neighbourhoods and provides for an integrated transport system.
- The Project will support the establishment of a metro-style rail system by delivering a separated road and rail crossing.

Environmental and Landscape Values

Clause 12 (Environmental and Landscape Values) seeks to assist the protection and conservation of Victoria's biodiversity and the health of ecological systems.

The amendment supports and implements the clause in the following manner:

- The design and construction of the Project will be in accordance with the EMF which will include measures to manage environmental impacts.
- The Incorporated Document requires that the removal, destruction or lopping of native vegetation be detailed in accordance with *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017), except as otherwise agreed by the Secretary to DELWP.
- The Incorporated Document requires native vegetation offsets to be provided in accordance with the guidelines except as otherwise agreed by the Secretary to DELWP.

Environmental Risks

Clause 13 (Environmental Risks) recognises that planning should adopt a best practice environmental management and risk management approach which aims to avoid or minimise environmental degradation and hazards.

The amendment supports and implements the clause in the following manner:

- The Project will be designed and constructed in accordance with an EMF which will include measures to reduce and manage environmental impacts of the Project.
- The Project has undertaken due-diligence specialist reports to consider a variety of environmental matters.

Built Environment and Heritage

Clause 15 (Build Environment and Heritage) requires that planning should ensure all new land use and development appropriate responds to its landscape, valued built form and cultural context, and protect places and sites with significant value.

The amendment supports and implements the clause in the following manner:

- The Project will be designed and delivered with reference to the *LXRA Urban Design Framework: Principals and Objectives, Measures and Qualitative Benchmarks, 2016* and site specific Urban Design Guidelines. The Framework and Guidelines outline the principles, objective, measures and benchmarks that will be considered during the development of the design of the Project, and seek to ensure that the resulting built form responds to and is cognisant of the local landscape, built form, urban fabric and cultural context.
- The Chelsea Station and Signal Box (HO31) is recognised as being of local heritage significance within the Kingston Planning Scheme. The Incorporated Document requires that the Project respond to the identified heritage values of the site.
- The Project will be undertaken in accordance with the approved CHMP for the Project area and the requirements of the AH Act.

Transport

Clause 18 (Transport) recognises that planning should facilitate greater use of public transport and ensure an integrated and sustainable transport system that provides access to social and economic opportunities, facilitates economic prosperity, contributes to environmental sustainability, coordinates reliable movements of people and goods, and is safe.

The amendment supports and implements the clause in the following manner:

- The Project will enable improved public transport infrastructure and services on the Principal Public Transport Network, improved accessibility to local, regional and metropolitan activity centres, locally, regionally and nationally significant employment corridors and precincts, and will contribute to economic development by delivering a more efficient road and rail system.
- This level crossing removal will improve safety by reducing conflicts between vehicles, trains, pedestrians and cyclists.
- The Project provides new shared use paths that will encourage the use of sustainable personal transport, support the development of 20-minute neighbourhoods and improve access to the public transport system.
- The Project will enable safer and more efficient movement of freight to meet local needs and service markets throughout Victoria by removing constraints on the current road network.
- The Project will provide opportunities for a reduction in greenhouse gas emissions through reduced road congestion and the increased facilitation of sustainable transport options.

How does the amendment support or implement the Local Planning Policy Framework, and specifically the Municipal Strategic Statement?

The amendment supports and implements the following clauses of the Local Planning Policy Framework (LPPF):

Kingston Planning Scheme

The amendment supports and implements the following clauses of the LPPF:

- Clause 21.01 Municipal Strategic Statement
- Clause 21.03 Land Use Challenges for the New Millennium
- Clause 21.04 Vision
- Clause 21.06 Retail and Commercial Land Use
- Clause 21.09 Environment, Wetlands and Waterways
- Clause 21.12 Transport, Movement and Access
- Clause 21.13 Heritage

The amendment supports and implements these clauses in the Kingston Planning Scheme as follows:

- The Project will improve reliability on the Frankston rail line, reduce congestion on the road network, increase safety on the rail, road, bicycle and pedestrian network and improve access to jobs and services.
- The Project will improve connectivity between Bonbeach to important local, regional and national activity and employment nodes in Melbourne's southern subregion.
- The Project will provide equitable and safe vehicular, pedestrian and cyclist movement and access for the community.

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- The Incorporated Document requires that the design and construction of the Project be in accordance with the EMF which will provide an overarching framework and specific measures to manage environmental, social and economic impacts.
- The Incorporated Document forming part of the amendment includes conditions requiring site plans and elevations, and/or a full photographic survey, be submitted to the satisfaction of the Minister for Planning where a planning permit would normally be required under a Heritage Overlay.

Does the amendment make proper use of the Victoria Planning Provisions?

The amendment makes proper use of the Victorian Planning Provisions, specifically Clause 52.03 and Clause 81.01 of the Kingston Planning Scheme to facilitate the Project.

The purpose of Clause 52.03 is to provide in extraordinary circumstances specific controls designed to achieve a particular land use and development outcome.

The use of this provision in this case is appropriate because the Project is of genuine State significance and the Incorporated Document proposed by the amendment will allow the Project to be developed and delivered in a coordinated, consistent and timely manner under a single planning control and will remove the need for the Project to seek multiple and separate planning permits. The site specific controls in this amendment are set out in the Incorporated Document and allow the use and development of the land in the project area for the purposes of the Project in accordance with the conditions set out in the Incorporated Document.

How does the amendment address the views of any relevant agency?

The views of relevant agencies and stakeholders have been considered through an extensive consultation framework as part of the EES process. The views of the following agencies and authorities have been considered:

- Aboriginal Victoria
- DEDJTR
- DELWP
- Department of the Environment and Energy (Commonwealth)
- Environment Protection Agency
- Frankston City Council
- Heritage Victoria
- Kingston City Council
- Melbourne Water
- Metro Trains Melbourne
- Office of the Victorian Government Architect
- Public Transport Victoria
- Southern Rural Water
- Transport for Victoria
- VicRoads
- VicTrack

Does the amendment address relevant requirements of the *Transport Integration Act 2010*?

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The amendment facilitates a project that is consistent with the vision statement in the *Transport Integration Act 2010* (**TI Act**) and addresses the key transport system objectives and decision-making principles in the TI Act, in the following ways:

Division 2 – System objectives

- *Social and economic inclusion*: The Project will support social and economic inclusion by improving the reliability of the rail network and increasing capacity of the road network in a key location, thereby expanding opportunities for access to social and economic opportunities, particularly in the surrounding key employment areas.
- *Economic prosperity*: The Project will support economic prosperity by creating jobs and facilitating easier access to employment opportunities in Melbourne's southern subregion and beyond. The Project will modernise and improve existing transport infrastructure which will achieve greater operational efficiencies for Victoria's rail and road networks.
- *Environmental sustainability*: The Project will improve the operational efficiency of the road network which will reduce environmental impacts caused by traffic congestion. Additionally, improvements in transport infrastructure will promote the efficient use of public transport in the overall transport system and it will support the development of the rail network as a sustainable transport option for all Victorians. The Project will be designed and constructed to achieve a design and as-built 'Excellent' 4 Star Green Star rating for the new station and a minimum 'Excellent' (65) Infrastructure Sustainability (IS) rating.
- *Integration of transport and land use*: The Project will be delivered within the existing rail corridor and nearby road reserves and maximizes integrations with the existing road network while minimizing impacts to proximate land uses. The Project is part of a wider program expected to contribute to a more efficient and reliable transport system which will encourage increased use of a sustainable mode of transport and facilitate better access to, and greater mobility within, local communities. The amendment will ensure the Project is delivered in a timely manner to support current and future requirements of the transport system and demands of the southern subregion of metropolitan Melbourne.
- *Efficiency, coordination and reliability*: The Project is part of a wider level crossing removal program that will facilitate network-wide efficient, coordinated and reliable movements of persons and vehicles.
- *Safety and health and wellbeing*: The Project will minimise conflict between trains, vehicles, cyclists and pedestrians and will improve road, rail and pedestrian safety, while the new Bonbeach Railway Station will be designed and constructed to enhance safety, functionality and usability.

Division 3 – Decision-making principles

- *Principle of integration decision making*: The Project has been the subject of a coordinated process that has incorporated the views of relevant agencies, statutory authorities, and local government.
- *Principle of triple bottom line assessment*: The economic, environmental and social costs and benefits of the Project have been considered. The investigations and assessments undertaken for the Project satisfy the principles of triple bottom-line assessment.
- *Principle of equity*: The Project will improve the overall operation of the transport system in Melbourne, including access to and from key activity and employment nodes within Melbourne's southern subregion, and will cater for the needs of existing and future businesses and communities. These rail services are available to all persons, and they provide transport opportunities to those who may not have alternative options such as ownership of a private vehicle.
- *Principle of the transport system user perspective*: The Project will facilitate improvements to the transport system which will improve the public transport experience for users.

- *Precautionary principle*: The precautionary principle was adopted during the development of the Project through specialist investigations due diligence evaluations to avoid serious or irreversible damage to the environment.
- *Principle of stakeholder engagement and community participation*: The Project is supported by a communications strategy which included consultation with local communities, transport system users and other key stakeholders.
- *Principle of transparency*: The Project is supported by a communications strategy which included consultation with local communities, transport system users and relevant agencies during the preparation of the amendment. Consultation will continue throughout the lifetime of the Project to provide transparency.

Resource and administrative costs

What impact will the new planning provisions have on the resource and administrative costs of the responsible authority?

The implementation of the new planning provisions will have minimal impact on the resource and administrative costs of the responsible authority.

Where you may inspect this amendment

The amendment can be inspected free of charge at the DELWP website at www.delwp.vic.gov.au/public-inspection.

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Planning and Environment Act 1987

KINGSTON PLANNING SCHEME

AMENDMENT C156

INSTRUCTION SHEET

The planning authority for this amendment is the Minister for Planning.

The Kingston Planning Scheme is amended as follows:

Planning Scheme Ordinance

The Planning Scheme Ordinance is amended as follows:

1. In Particular Provisions – Clause 52.03, replace the Schedule with a new Schedule in the form of the attached document.

2. In Incorporated Documents – Clause 81.01, replace the Schedule with a new Schedule in the form of the attached document.

End of document

07/12/2017
~~GC71~~
Proposed C156

SCHEDULE TO CLAUSE 52.03 SPECIFIC SITES AND EXCLUSIONS

1.0 Specific sites and exclusions

07/12/2017
~~GC71~~
Proposed C156

Address of land	Title of incorporated document
North - west corner of Main Road and McMillan Street, Oakleigh South described in Certificates of Title: Volume 8069 Folio 008 Volume 8952 Folio 684 Volume 8952 Folio 685 Volume 8952 Folio 686 Volume 8952 Folio 687 Volume 8952 Folio 688 Volume 8795 Folio 387	Existing Provision Document 1
477 - 481 Warrigal Road, Moorabbin (part) Certificate of Title Volume 9630 Folio 075 (part) Plan of Subdivision 305551M (part) and associated storage units, 21 32, 41, 46, 48, 49, 52, 63 - 67 fronting Warrigal Road Title Volume 10059 Folios 563 – 574	Existing Provision Document 2
88 Beach Road, Mentone	Existing Provision Document 3
South east corner of Centre Dandenong Road and Boundary Roads, Braeside, known as part of Redwood Gardens Industrial Estate	Existing Provision Document 4
No. 1 Rhode Island, Patterson Lakes	Existing Provision Document 5
No. 2 Rhode Island, Patterson Lakes	Existing Provision Document 6
Capital Golf Course – Centre Dandenong Road, Old Dandenong Road, Madden Road and Ross Street, Heatherton. Part Crown Allotments 1,2 and 3, Section 15 Parish of Mordialloc	Existing Provision Document 7
Kingston Heath Golf Course - Kingston Road, Heatherton, Lot 2 on LP. 92000, Parish of Mordialloc	Existing Provision Document 8
462-508 Heatherton Road, Springvale South Certificate of Title Volume 9249 Folio 658	Existing Provision Document 9
The Caulfield Dandenong Rail Upgrade Project land as shown on the maps in the incorporated document.	Caulfield Dandenong Rail Upgrade Project, Incorporated Document, April 2016
Tootal Road, Dingley (known as Lot 1 Grange Road, and 370-440 Old Dandenong Road, Dingley Village) as described in the following certificates of title: ▪ Volume 8077, Folio 174 (Lot 1 of PS 29928). ▪ Volume 8163 Folio 419 (Lot 1 of PS33174). ▪ Volume 8523 Folio 416 (Lot 1 of	Hawthorn Football Club – Function Centre and Signage Controls, Tootal Road, Dingley Village, May 2016

PS 65354). ▪ Volume 8523 Folio 416 (Lot 2 of PS 65354). ▪ Volume 2983 Folio 481 (Lot 1 of TP 561896E). ▪ Volume 8248 Folio 226 (Lot 1 of PS 46359). ▪ Northern portion of Volume 8713 Folio 097 (Lot 1 PS 79066). ▪ Northern portion of Volume 10316 Folio 734 (Lot 4 of PS 404673U). ▪ Northern portion of Volume 8452 Folio 805 (Lot 1 of PS 61906).	
Land required for the Cheltenham Level Crossing Removal Project as shown on the project area maps in the incorporated document.	Cheltenham Level Crossing Removal Project Incorporated Document, July 2017
Land required for the Carrum Level Crossing Removal Project as shown on the project area maps in the incorporated document.	Carrum Level Crossing Removal Project Incorporated Document, December 2017
Land required for the Station Street/Bondi Road, Bonbeach Level Crossing Removal Project as shown on the project area maps in in the Incorporated Document.	Station Street/Bondi Road, Bonbeach Level Crossing Removal Project Incorporated Document, January 2018

07/12/2017
~~GC71~~
Proposed C156

SCHEDULE TO CLAUSE 81.01 TABLE OF DOCUMENTS INCORPORATED IN THIS SCHEME

1.0 Incorporated documents

07/12/2017
~~GC71~~
Proposed C156

Name of document	Introduced by:
Australian Standard AS2021-2015, Acoustics – Aircraft Noise Intrusion – Building Siting and Construction, Standards Australia Limited, 2015	VC107
Aspendale Gardens Incorporated Plan, 1 November 1999	NPS1
Carrum Level Crossing Removal Project Incorporated Document, December 2017	GC71
Caulfield Dandenong Rail Upgrade Project, Incorporated Document, April 2016	GC37
Cheltenham Level Crossing Removal Project Incorporated Document, July 2017	GC70
Clayton South Medium Density Housing Development Guidelines, May 2003	C10
Documents Incorporated Under Clause 52.03 – Specific Sites and Exclusions	
▪ Existing Provision Document 1	NPS1
▪ Existing Provision Document 2	NPS1
▪ Existing Provision Document 3	NPS1
▪ Existing Provision Document 4	NPS1
▪ Existing Provision Document 5	NPS1
▪ Existing Provision Document 6	NPS1
▪ Existing Provision Document 7	NPS1
▪ Existing Provision Document 8	NPS1
▪ Existing Provision Document 9	NPS1
Draft Guidelines for the assessment of heritage planning applications, August 2000	C46(Part 2)
Endeavour Cove Comprehensive Development Plan, December 1999	NPS1
Hawthorn Football Club – Function Centre and Signage Controls, Tootal Road, Dingley Village, May 2016	C161
Heatherton Christian College, Master Plan, June 2007	C94
Kingston Lodge Concept Plan, 2006	C71
Kingston Lodge Precinct Development Plan, 2 December 1997	NPS1
Kingston Neighbourhood Character Guidelines, August 2007	C77
Siting and Design Guidelines for Structures on the Victorian Coast, May 1998	C2
Station Street/Bondi Road, Bonbeach Level Crossing Removal Project Incorporated Document, January 2018	C156
Wells Road, Aspendale Gardens Landscape Concept Plan for Outline Development Plan, September 1999	NPS1
Westfield Shoppingtown Southland Concept Plan, November 1994	NPS1

Station Street/Bondi Road, Bonbeach Level Crossing Removal Project

Incorporated Document

January 2018

Incorporated document pursuant to section 6(2)(j) of the *Planning and Environment Act 1987*

1.0 INTRODUCTION

This document is an incorporated document in the Kingston Planning Scheme (**planning scheme**) and is made pursuant to section 6(2)(j) of the *Planning and Environment Act 1987*.

The land identified in Clause 3.0 of this document may be used and developed in accordance with the specific controls in Clause 4.0 of this document.

The control in this document prevails over any contrary or inconsistent provision in the planning scheme.

2.0 PURPOSE

The purpose of this incorporated document is to allow the use and development of land for the purposes of the Station Street/Bondi Road, Bonbeach Level Crossing Removal Project, including a railway, railway station, and associated upgrades to the road and rail network (**Project**).

3.0 LAND

The control in this document applies to the land required for the Project as shown in the Project Area Maps forming part of this document (**Land**).

4.0 CONTROL

4.1 EXEMPTION FROM PLANNING SCHEME REQUIREMENTS

Despite any provision to the contrary or any inconsistent provision in the planning scheme, no planning permit is required for, and no planning provision in the planning scheme operates to prohibit, or restrict or regulate the use or development of the Land for the purposes of the Project.

The Project includes, but is not limited to, the following:

a) Removal of the level crossing at Station Street/Bondi Road, Bonbeach where it crosses the Frankston rail line.

b) Railway construction and associated works to lower the existing Frankston rail line under Station Street/Bondi Road, including, but not limited to, bulk excavation, relocation of existing utilities and installation of new utility infrastructure, earthworks, installation of drainage and retaining walls, replacement of track infrastructure, access tracks, landscaping, vegetation removal and construction of bicycle and pedestrian shared use paths.

c) Road construction and associated works including construction of a road bridge over the Frankston rail line at Station Street/Bondi Road and associated works including alterations to road access arrangements.

d) Development of a new railway station, including provision for the sale of food, drink and other convenience goods and services, decking over the trench, car parking, bicycle facilities and loading and unloading facilities.

e) Provision of pedestrian access and shared bicycle use paths, including the

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construction of pedestrian bridges over the railway line.

f) Associated rail infrastructure, including power upgrades and overhead infrastructure, cabling and signaling.

g) Creation and alteration of access to roads.

h) Ancillary activities, preparatory and enabling works, including, but not limited to:

  i) Use and development of lay down areas for construction purposes.

  ii) Stockpiling of excavation material.

  iii) Use and development of temporary site workshops and storage, administration and amenities buildings, access and vehicle parking.

  iv) Removal, destruction or lopping of trees and vegetation, including native vegetation and dead native vegetation.

  v) Demolition and removal of buildings, structures and works.

  vi) Relocation, modification and upgrade of services and utilities.

  vii) Construction of fences, temporary site barriers and site security.

  viii) Construction or carrying out works to create or alter roads, car parking areas, bunds, mounds, landscaping, excavate land, salvage artefacts and alter drainage.

  ix) Earthworks including cutting, stockpiling and removal of spoil, and the formation of drainage works.

  x) Display of construction, directional or identification signs.

  xi) Subdivision and consolidation of land.

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4.2 CONDITIONS

The use and development permitted by this document must be undertaken in accordance with the following conditions:

Environmental Management Framework

4.2.1 The Project must be designed and constructed in accordance with the Edithvale and Bonbeach Level Crossing Removal Project EES Environmental Management Framework (**EMF**).

4.2.2 The EMF may be amended from time to time, to the satisfaction of the Minister for Planning.

Native Vegetation

4.2.2 Details of the proposed removal, destruction or lopping of native vegetation necessary for the construction of the Project must be prepared in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017) to the satisfaction of the Secretary to the Department of Environment, Land, Water and Planning (**DELWP**), except as otherwise agreed by the Secretary to DELWP.

4.2.3 Native vegetation offsets must be provided in accordance with the *Guidelines* *for the removal, destruction or lopping of native vegetation* (DELWP, 2017), except as otherwise agreed by the Secretary to DELWP.

Heritage Management

4.2.4 Where, but for this incorporated document, a planning permit would be required for buildings and works or subdivision within a Heritage Overlay, site plans and elevations showing the extent of buildings and works must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.

4.2.5 Where, but for this incorporated document, a planning permit would be required for the demolition, alteration, or removal of a building within a Heritage Overlay, a full photographic survey of the buildings, comprising photographs of both the exterior and interiors of the buildings and contextual images of the buildings environs and their settings, must be prepared to the satisfaction of the Minister for Planning, except as otherwise agreed by the Minister for Planning.

Road Access

4.2.6 The creation and alteration of access to a road in a Road Zone Category 1 must be to the satisfaction of the Roads Corporation.

4.2.7 Subdivision of land adjacent to a road in a Road Zone Category 1 must be to the satisfaction of the Roads Corporation.

Other Conditions

4.2.8 Unless otherwise stated, the plans and other documents listed in Clause 4.2 must be approved prior to the commencement of works. Plans and other documents may be prepared and approved for separate components or stages of the Project but each plan or other document must be approved before commencement of works for that component or stage.

4.2.9 The plans and other documents may be amended from time to time to the satisfaction of the Minister for Planning or the relevant approving authority. In deciding whether a plan or other document is satisfactory or whether to consent to an amendment to a plan or other document, the Minister for Planning or the relevant approving authority may seek the views of council and any other relevant authority.

4.2.10 The use and development of the Land must be undertaken generally in accordance with the approved plans and documents.

4.3 PREPARATORY AND OTHER WORKS

The following buildings and works and uses may commence on the Land prior to the approval of the plans and other documents listed in Clause 4.2:

a) Preparatory works for the Project including but not limited to:

  i) Works, including vegetation removal, where but for this incorporated document, a planning permit would not be required under the provisions of the planning scheme.

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    ii) Investigation, testing and preparatory works to determine the suitability of land, and property condition surveys.
    iii) Construction access points and working platforms.
    iv) Site establishment works including temporary site fencing and hoarding, site offices, and hardstand and laydown areas.
    v) Construction, protection, modification, removal or relocation of utility services, rail signaling, overhead and associated infrastructure.
    vi) Establishment of environment and traffic controls, including designation of 'no-go' zones.
    vii) Establishment of temporary car parking.
    viii) Demolition to the minimum extent necessary, to enable preparatory works.
    ix) Salvage and relocation of aboriginal cultural heritage material and other management actions in accordance with the relevant Cultural Heritage Management Plan approved under the *Aboriginal Heritage Act 2006* or otherwise in compliance with that Act.

b) The removal, destruction or lopping of native vegetation to the minimum extent necessary to enable preparatory works to the satisfaction of the Minister for Planning. Any native vegetation removed to enable preparatory works forms part of the total extent of native vegetation removal necessary for the construction of the Project and native vegetation offsets must be provided in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (DELWP, 2017) except as otherwise agreed by the Secretary to DELWP.

5.0 EXPIRY

The controls in this document expire if any of the following circumstances apply:

- The development allowed by the controls, including preparatory works, are not started by 1 December 2020.
- The development allowed by the controls are not completed by 1 December 2025.

The Minister for Planning may extend these periods if a request is made in writing before the expiry date or within three months afterwards.

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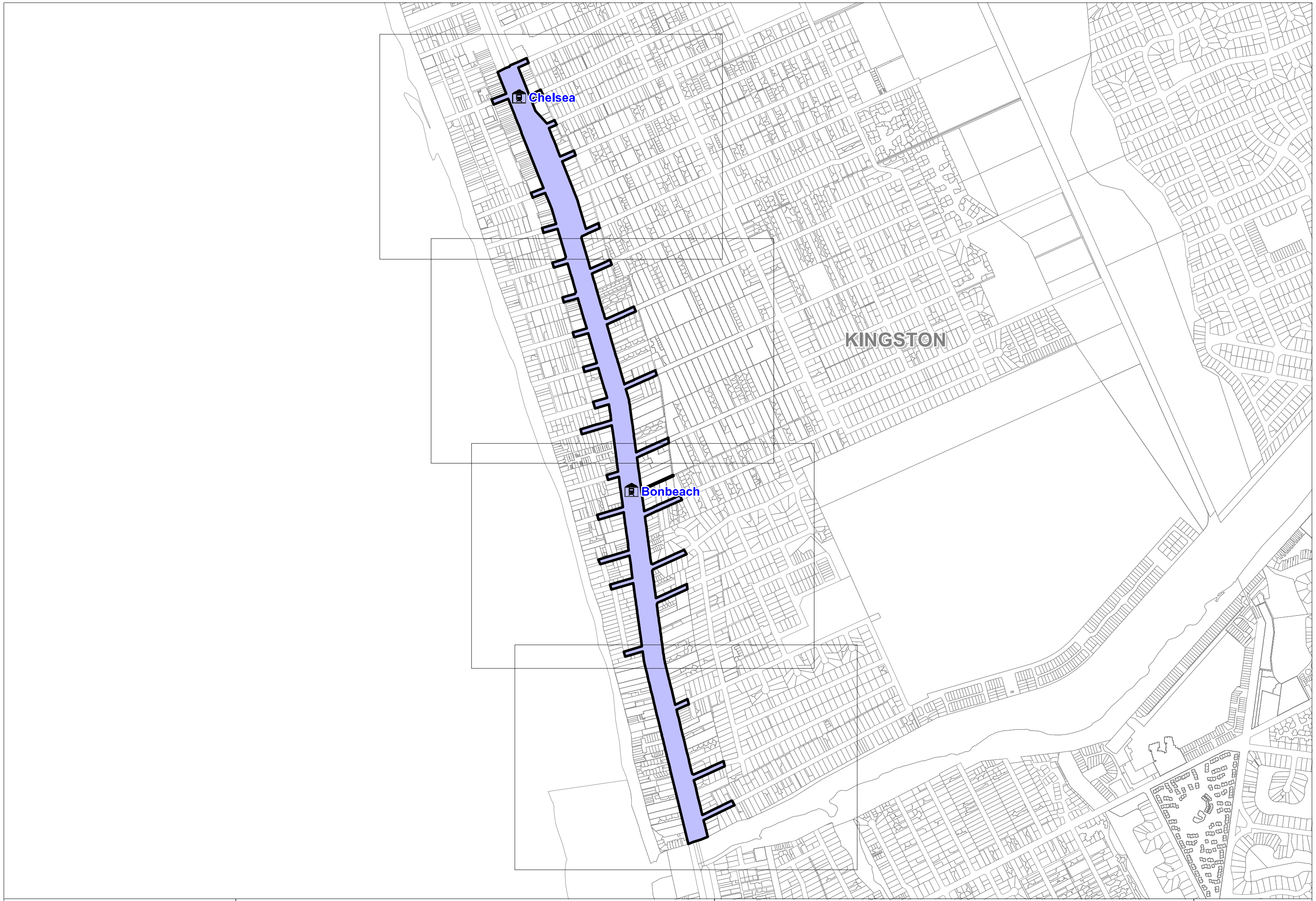

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INDEX

Date: 12/01/2018

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LEGEND

🟪 Bondi Road/Station Street, Bonbeach - EES Project Area

🚉 Railway Station

☐ VicMap Cadastre

BONDI ROAD/STATION STREET BONBEACH - EES PROJECT AREA

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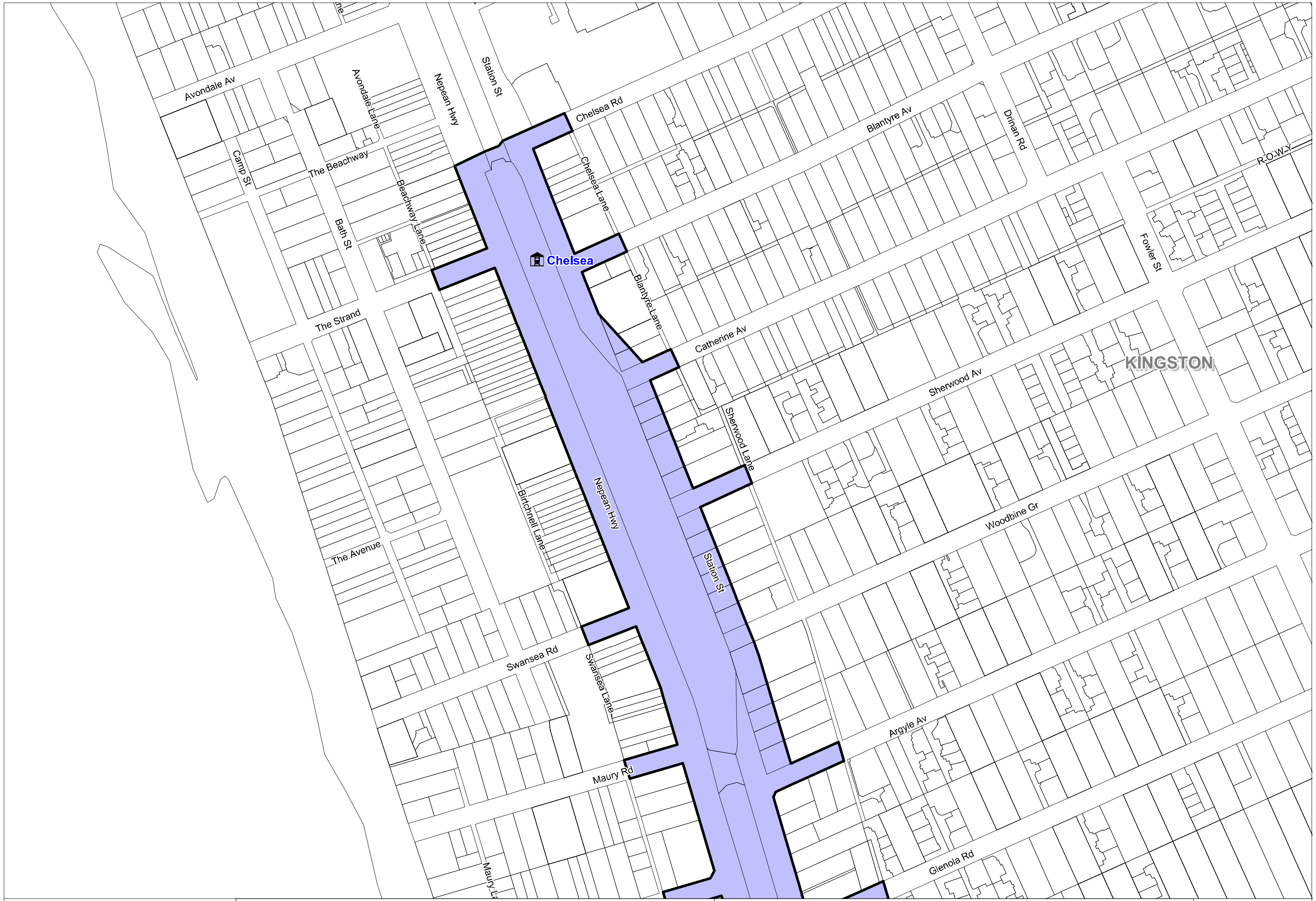

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Sheet 1 of 4

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LEGEND

▨ Bondi Road/Station Street, Bonbeach - EES Project Area

🚉 Railway Station

☐ VicMap Cadastre

BONDI ROAD/STATION STREET BONBEACH - EES PROJECT AREA

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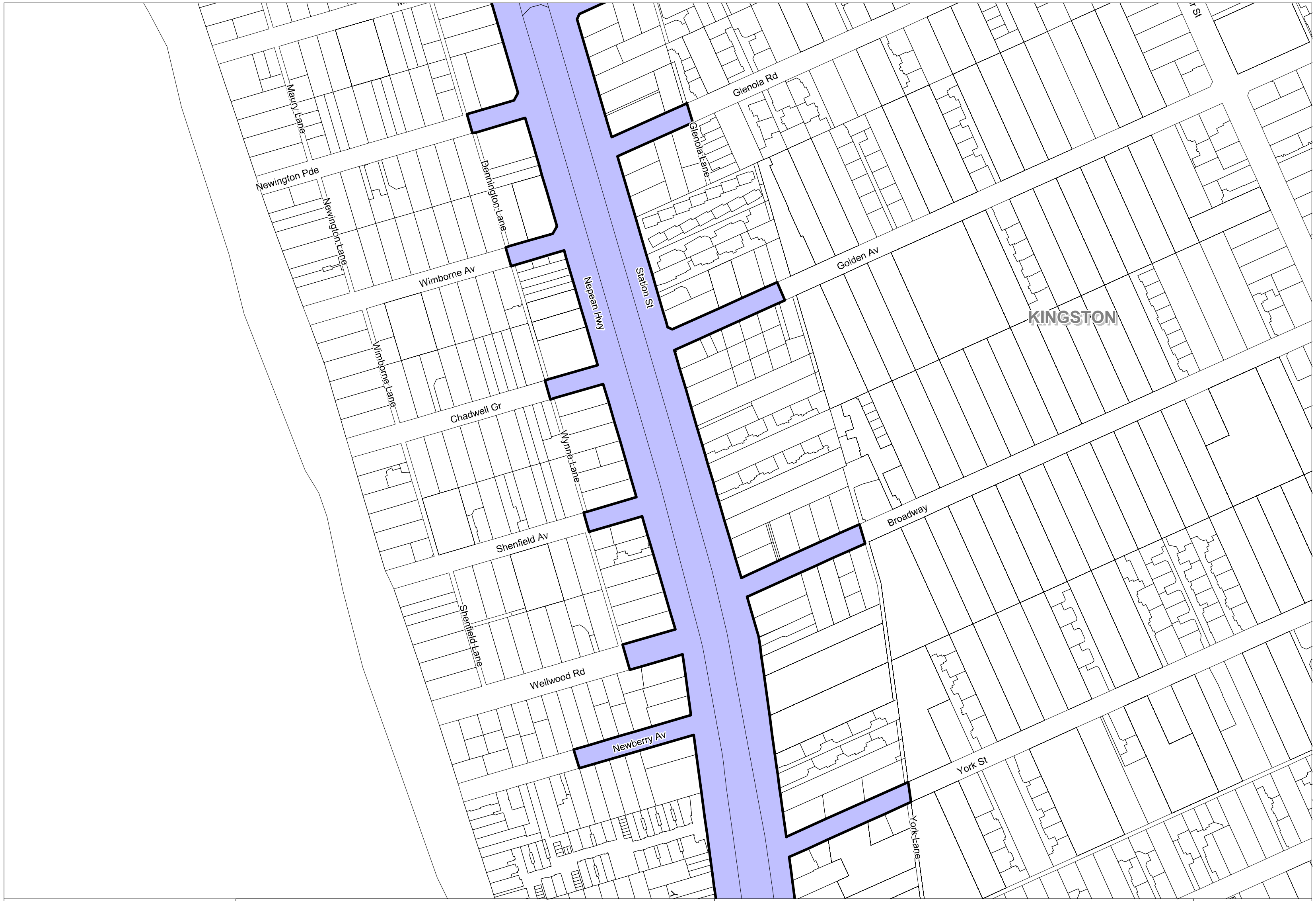

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Sheet 2 of 4
Date: 12/01/2018

LEGEND

▨ Bondi Road/Station Street, Bonbeach - EES Project Area

Railway Station

☐ VicMap Cadastre

BONDI ROAD/STATION STREET BONBEACH - EES PROJECT AREA

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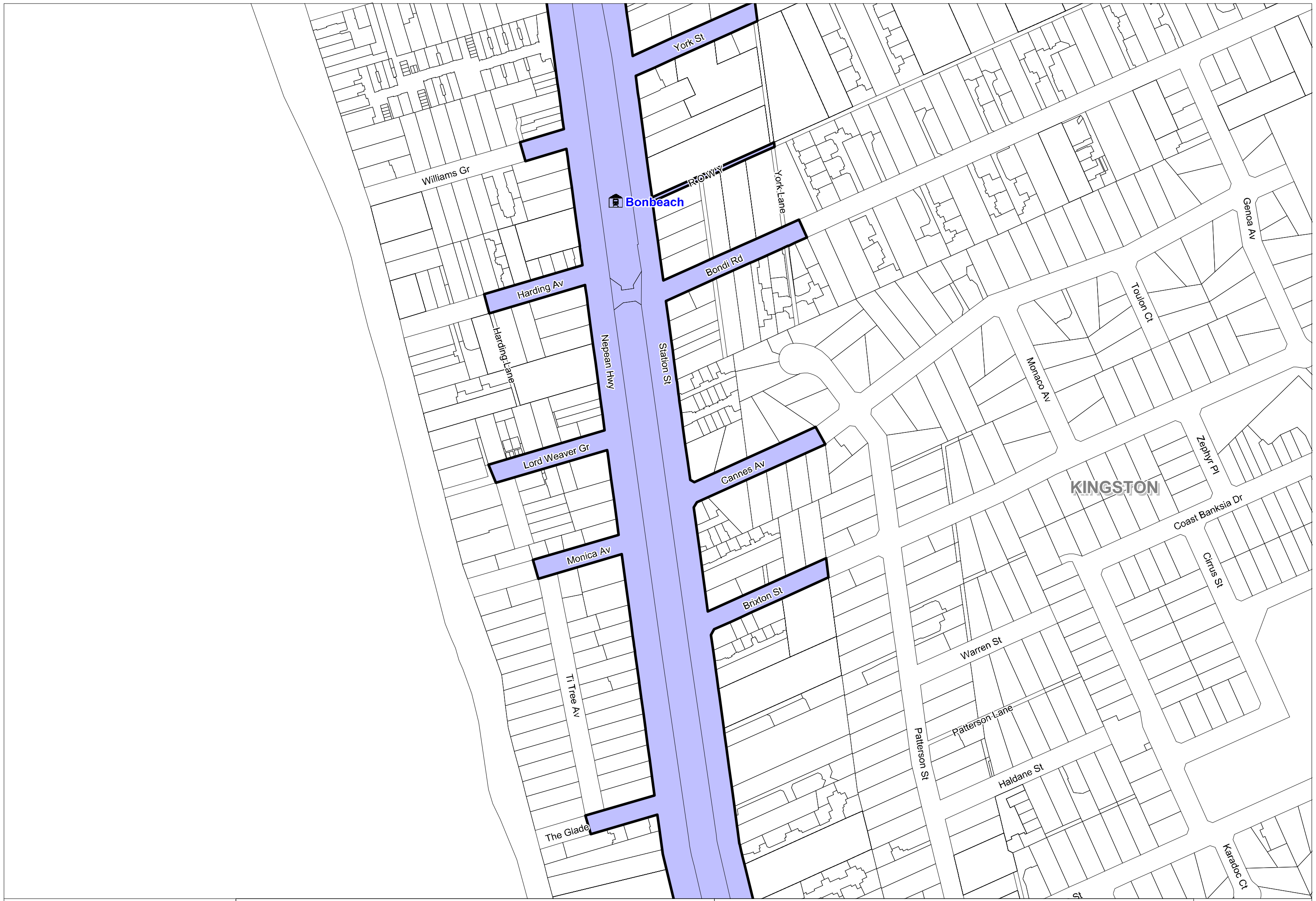

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Sheet 3 of 4

Date: 12/01/2018

LEGEND

▭ Bondi Road/Station Street, Bonbeach - EES Project Area

🚉 Railway Station

▭ VicMap Cadastre

BONDI ROAD/STATION STREET BONBEACH - EES PROJECT AREA

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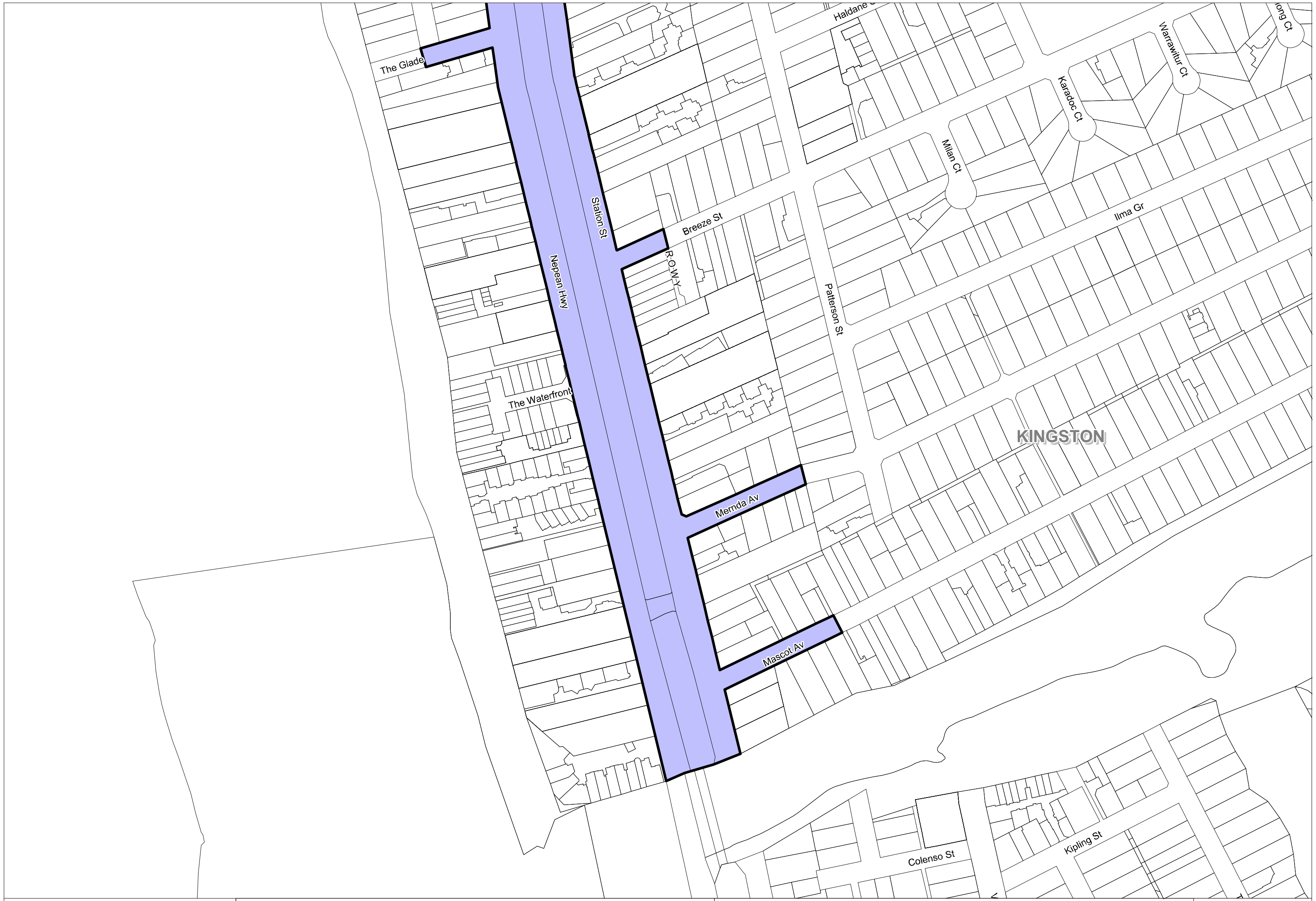

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Date: 12/01/2018

LEGEND

🟦 Bondi Road/Station Street, Bonbeach - EES Project Area

Railway Station

☐ VicMap Cadastre

BONDI ROAD/STATION STREET BONBEACH - EES PROJECT AREA

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ATTACHMENT VI: MAP BOOK

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Edithvale and Bonbeach project areas

Regional context VI.2

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Regional context VI.3
Aerial VI.4
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Bonbeach project area

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Cadastre VI.38
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Design VI.53

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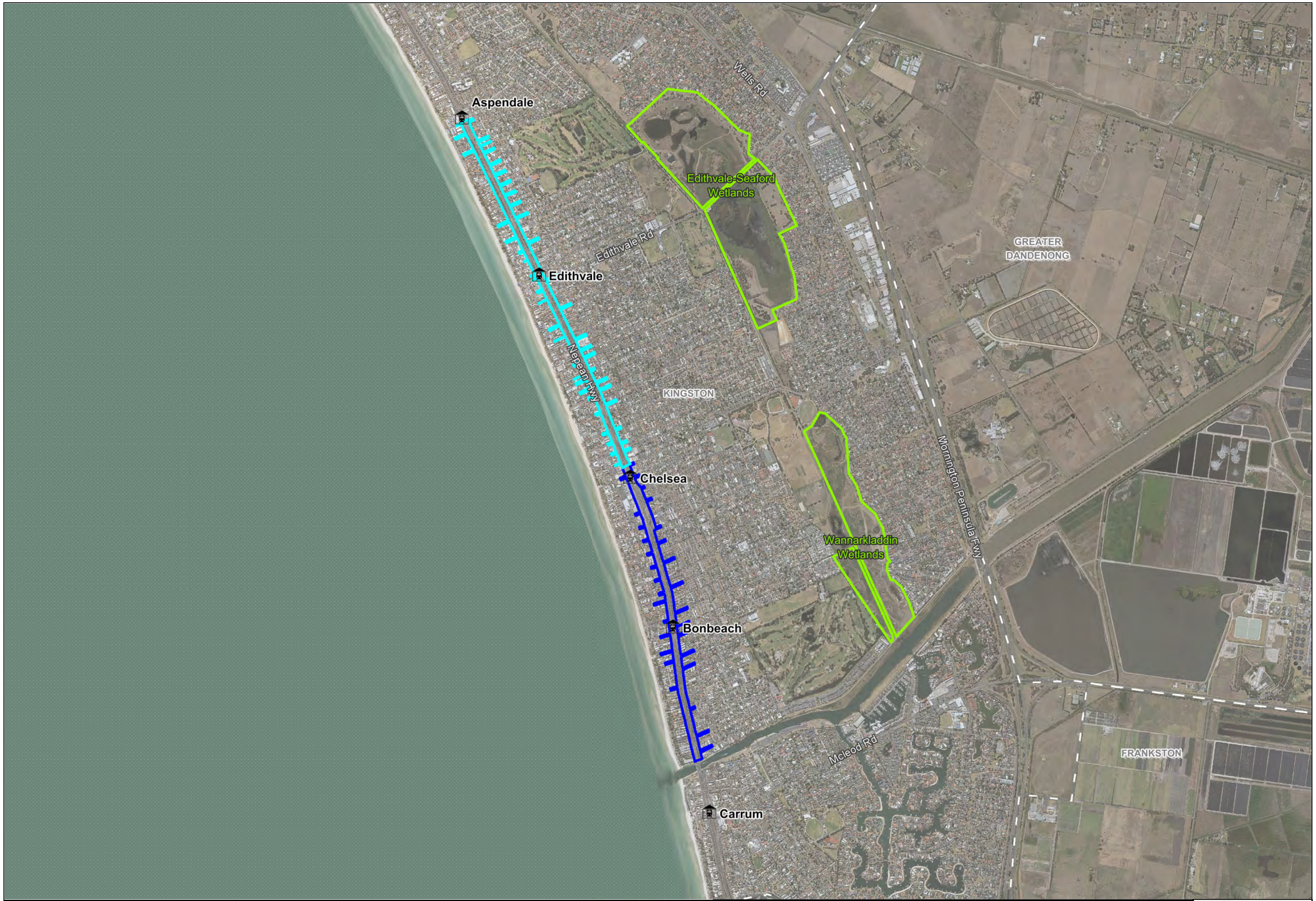

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Date: 16/02/2018

LEGEND

🟦 Station Street/Bondi Road, Bonbeach - EES Project Area
🟦 Edithvale Road, Edithvale - EES Project Area
🏠 Railway Station
🟩 Wetlands

EDITHVALE ROAD, EDITHVALE AND STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREAS - REGION

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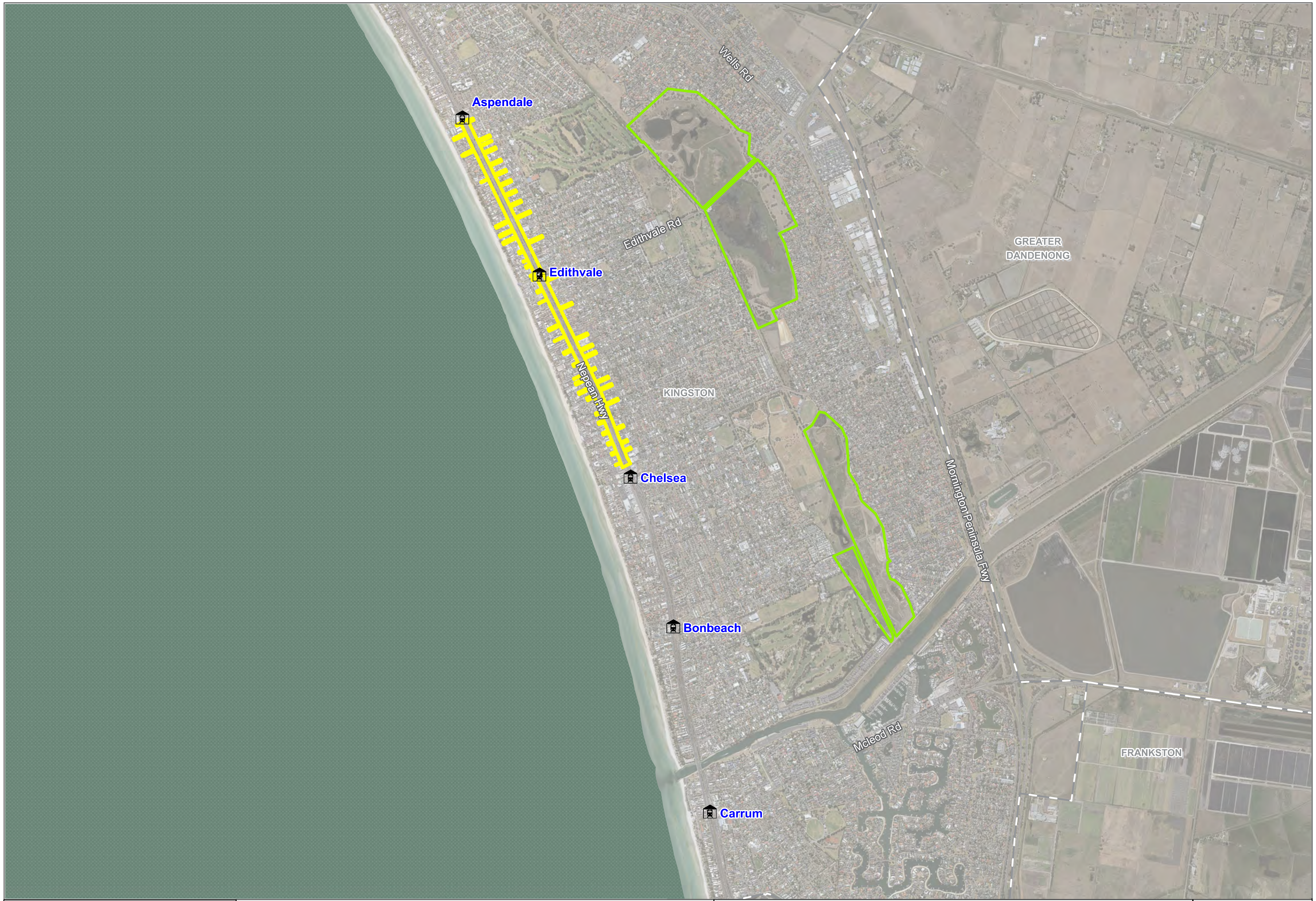

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🟨	Edithvale Road, Edithvale - EES Project Area
🚉	Railway Station
🟩	Wetlands

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA - REGION

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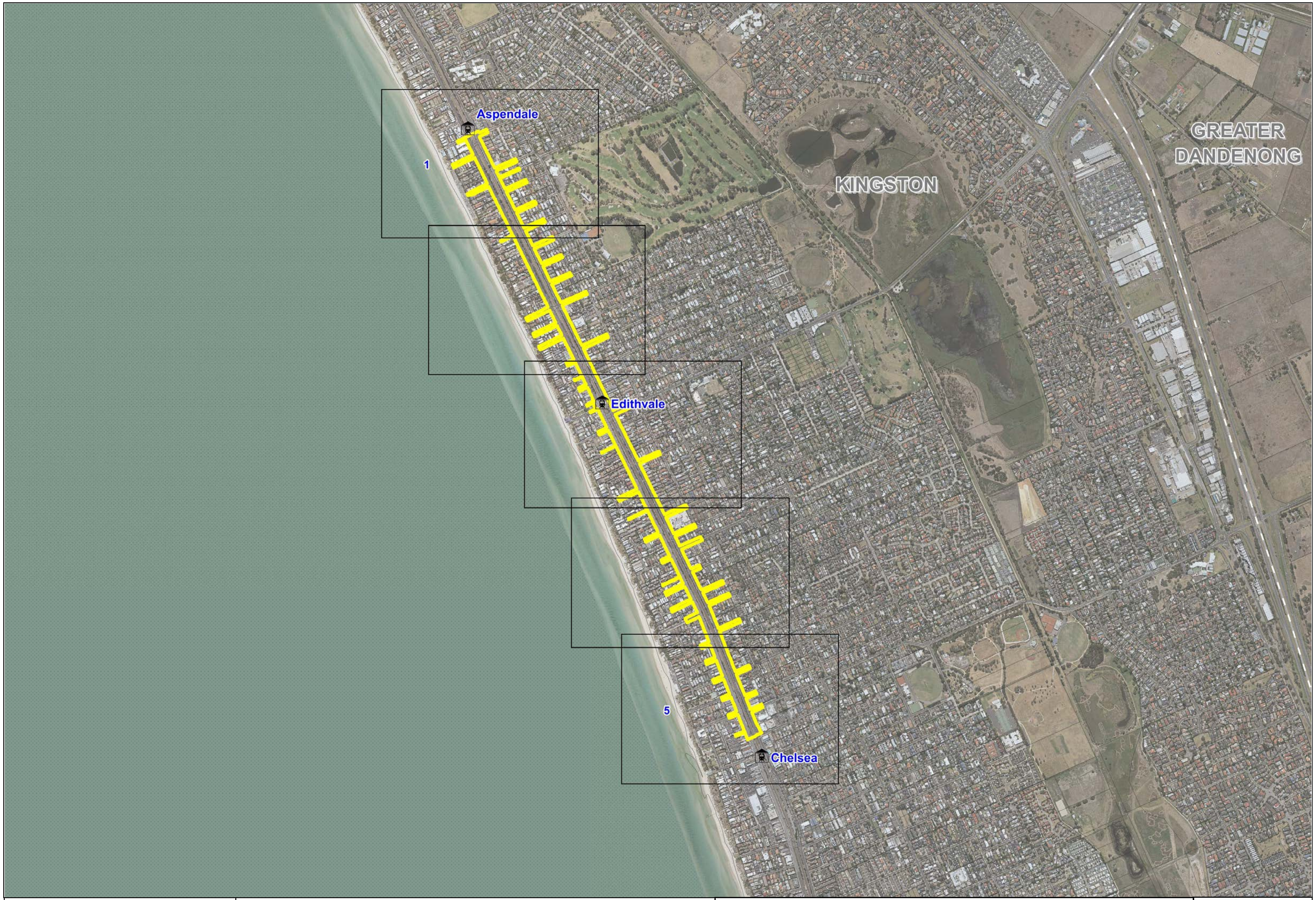

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🟨 Edithvale Road, Edithvale - EES Project Area

Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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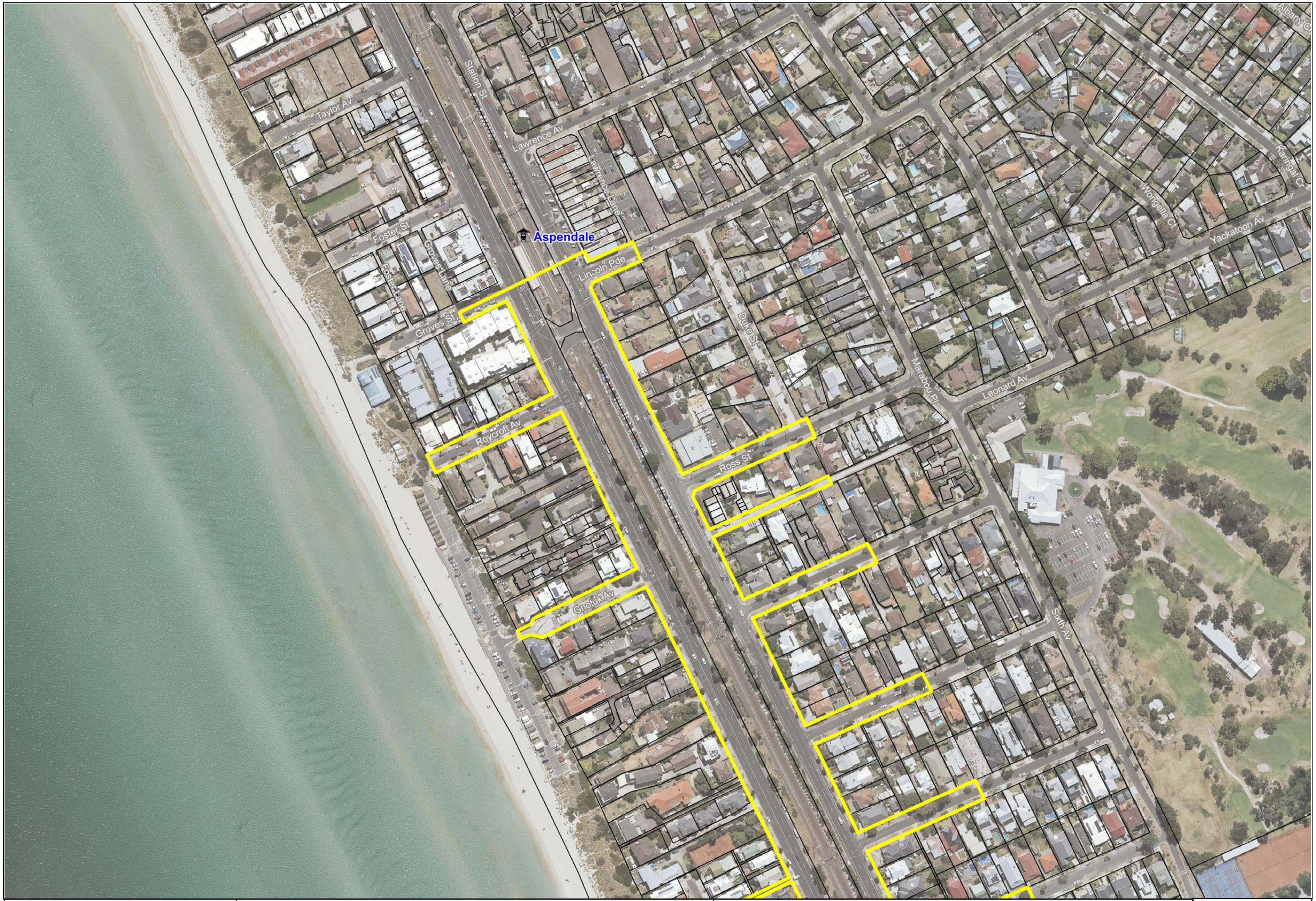

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Sheet 1 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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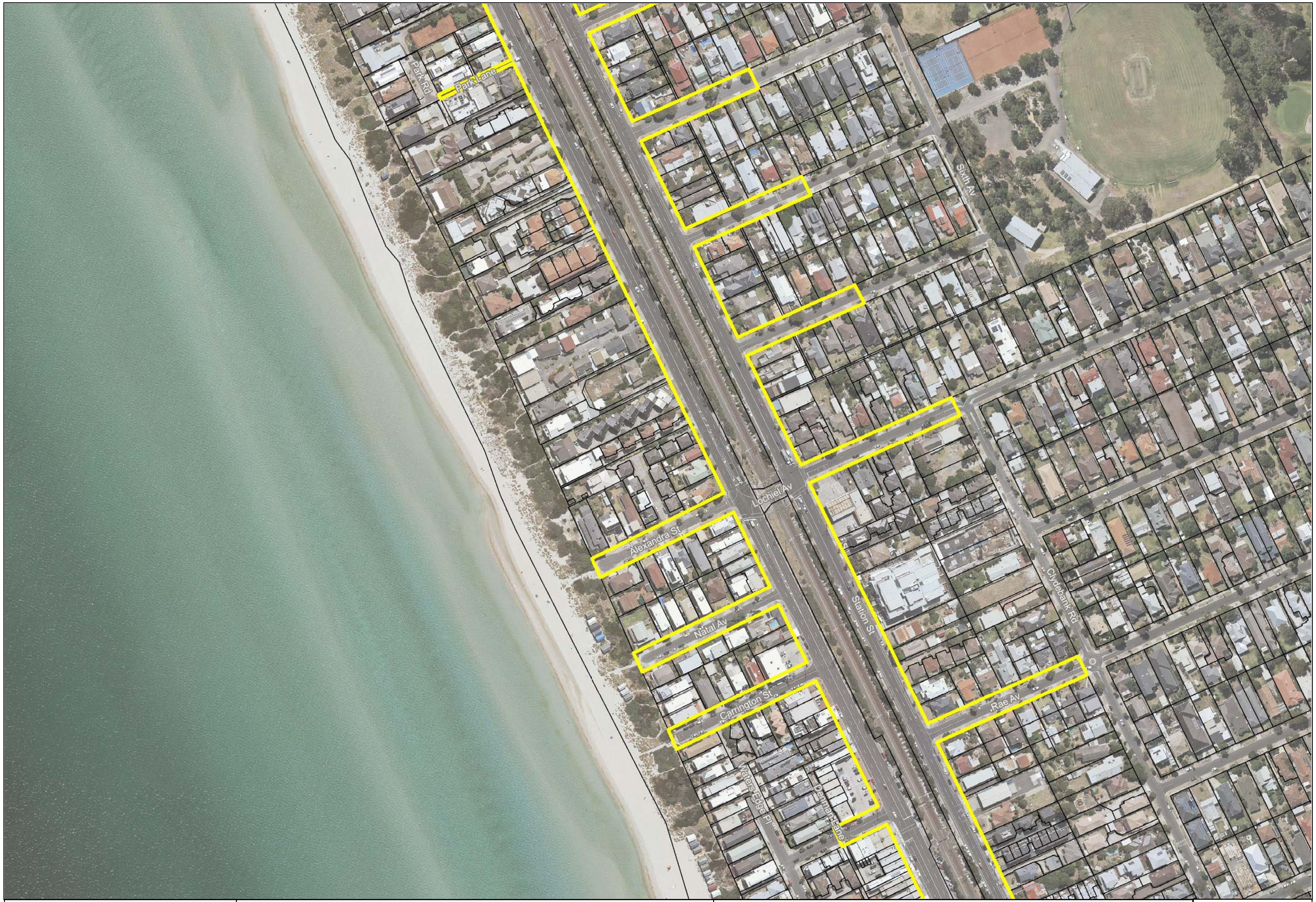

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Sheet 2 of 5

Date: 16/02/2018

LEGEND

🟨 Edithvale Road, Edithvale - EES Project Area

🚉 Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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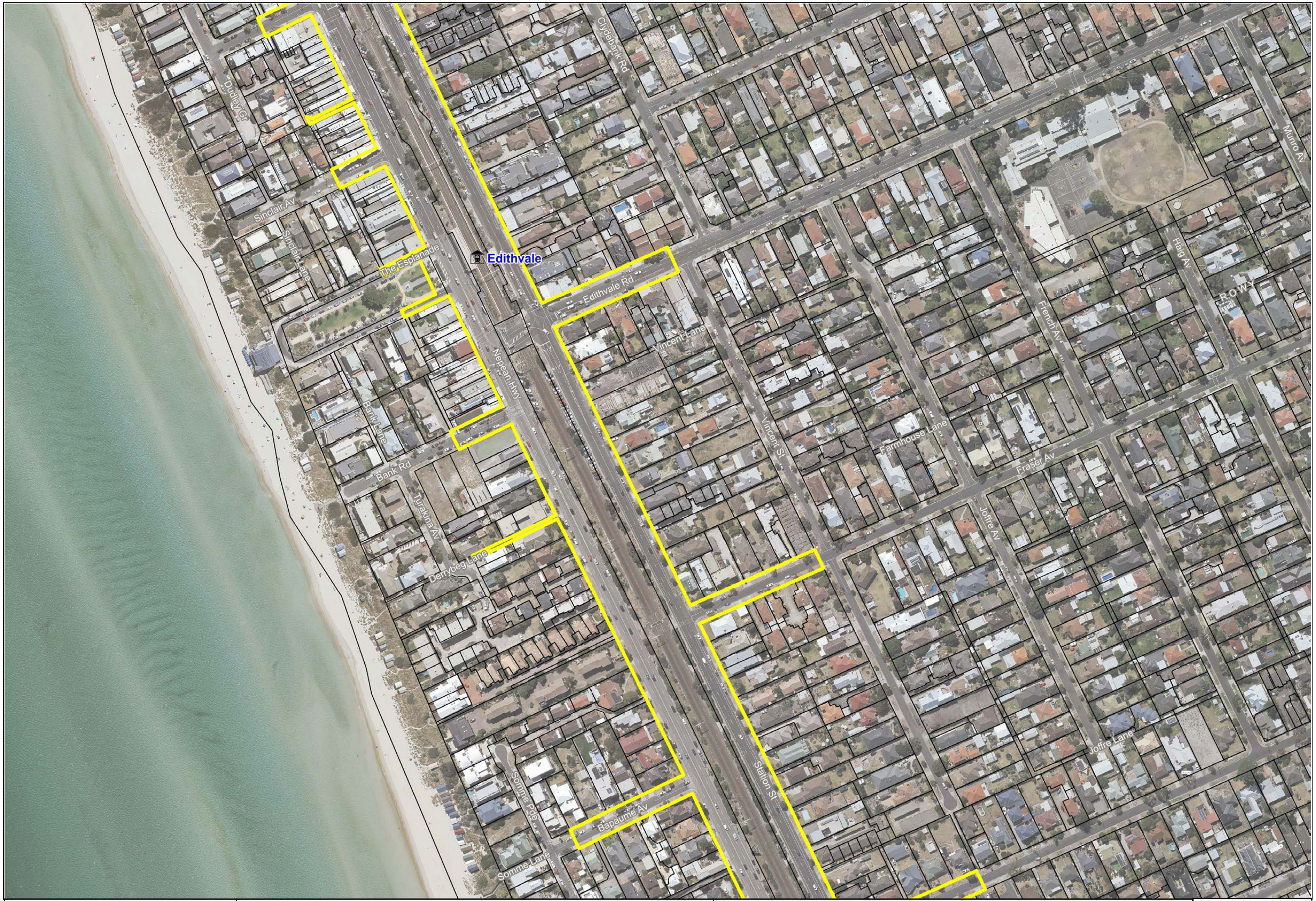

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LEGEND

🟨 Edithvale Road, Edithvale - EES Project Area

🚉 Railway Station

☐ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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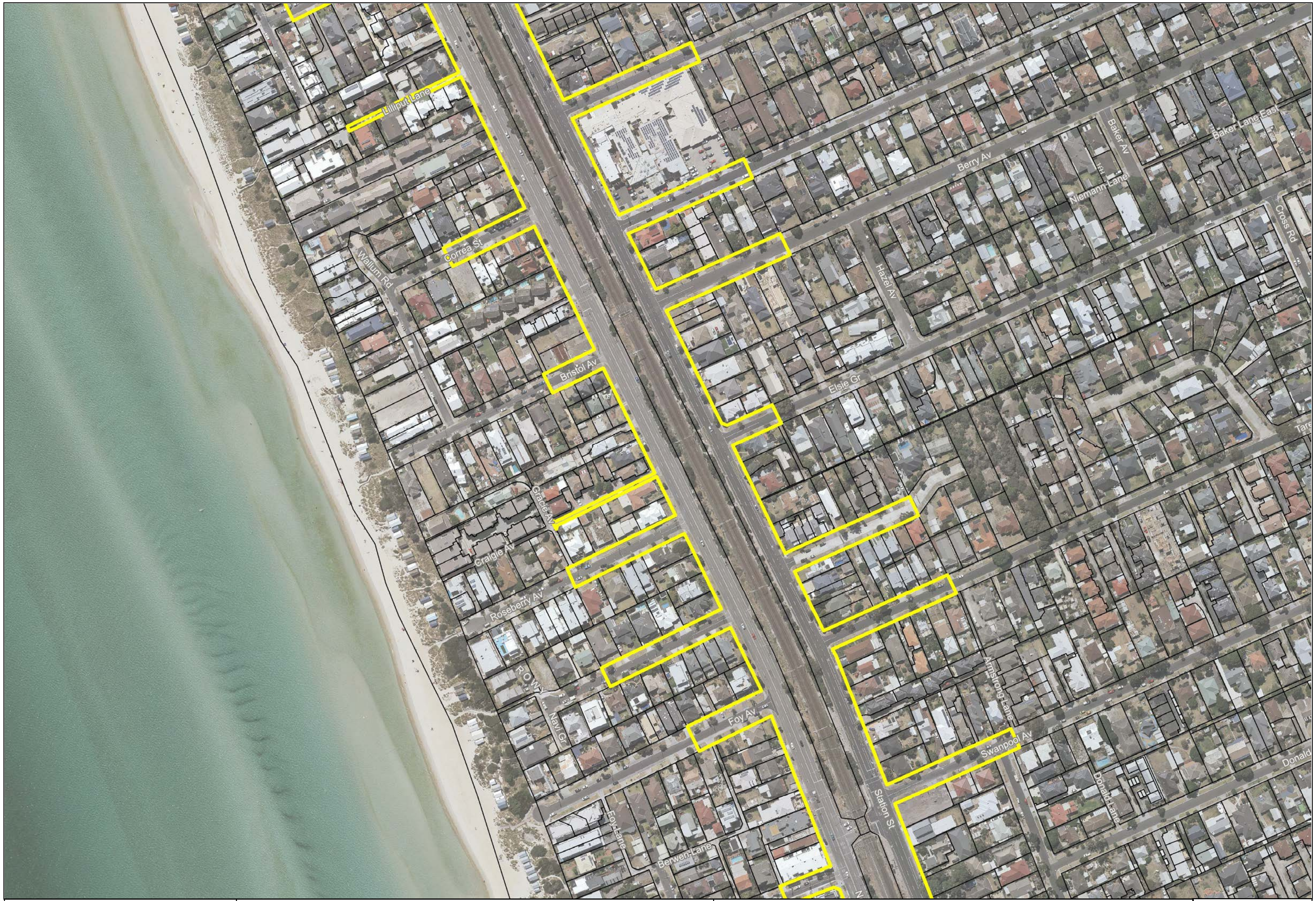

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Sheet 4 of 5

Date: 16/02/2018

LEGEND

🟨	Edithvale Road, Edithvale - EES Project Area
🚉	Railway Station
▭	VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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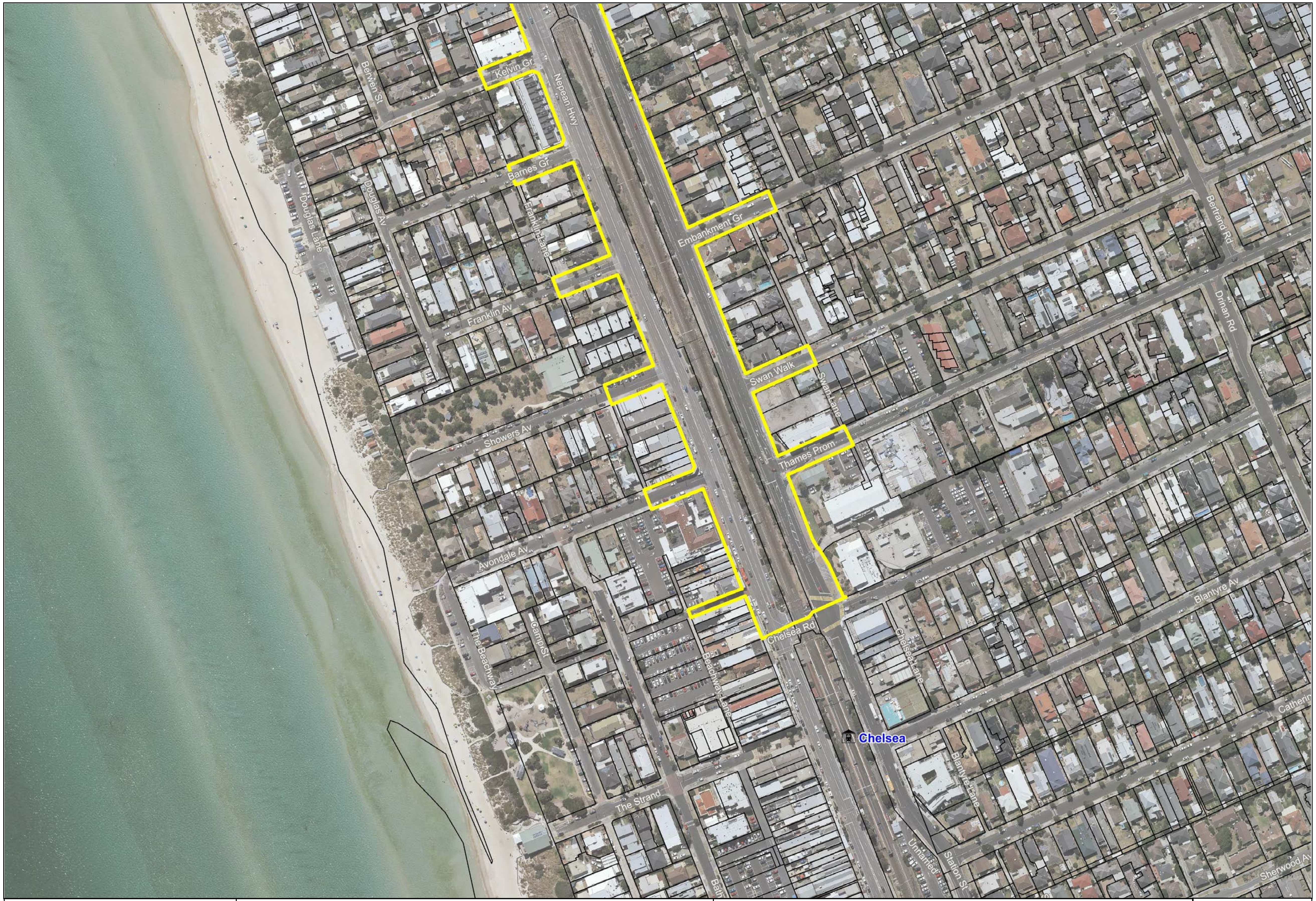

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LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

🚉 Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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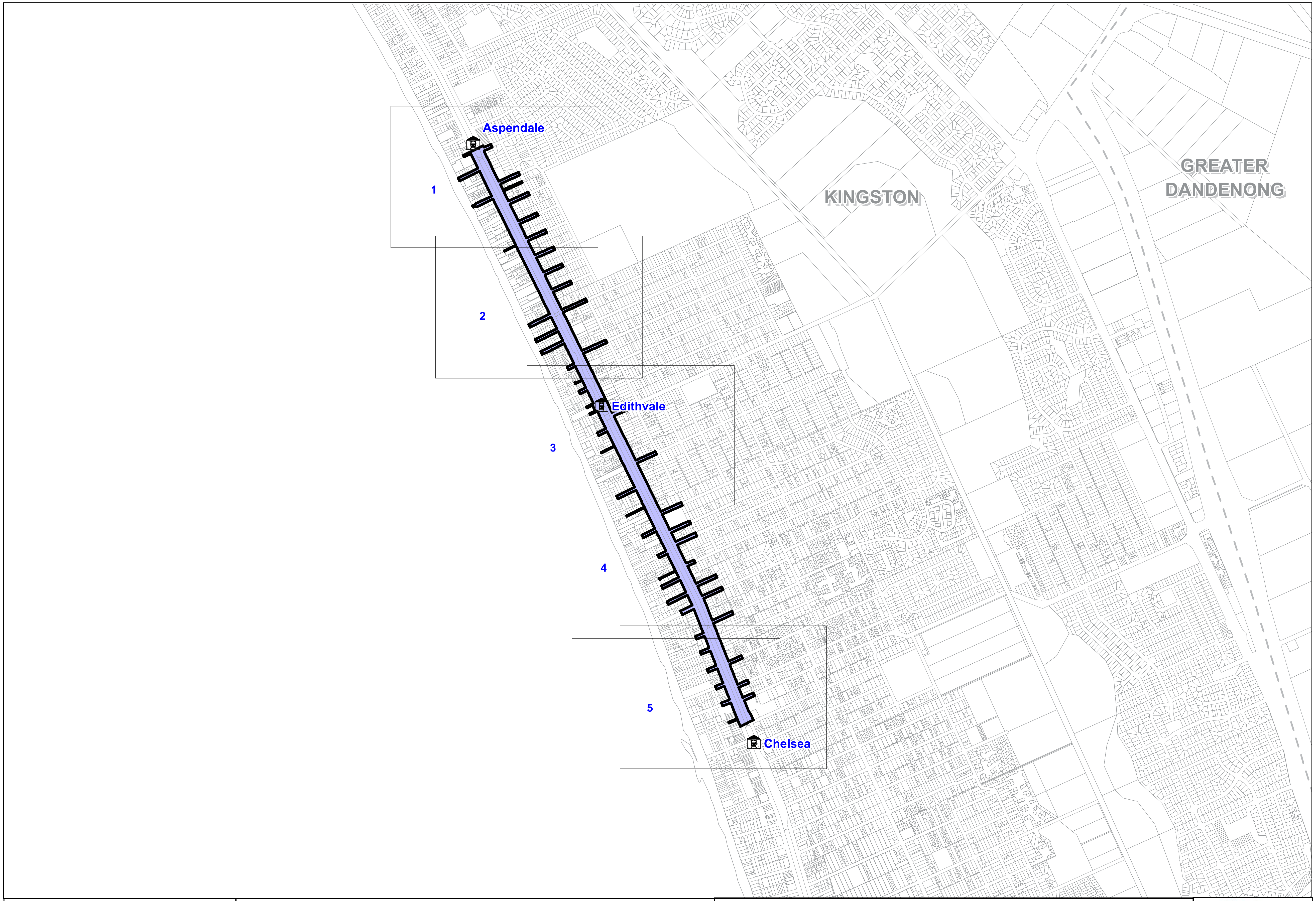

LEGEND

▭	Edithvale Road, Edithvale - EES Project Area
🚉	Railway Station
▭	VicMap Cadastre

INDEX

Date: 16/02/2018

X:\Workspaces\Frankston Group\Edithvale Road\PPA\EES\EdithvaleRd_EES_Parcel_v3.wor

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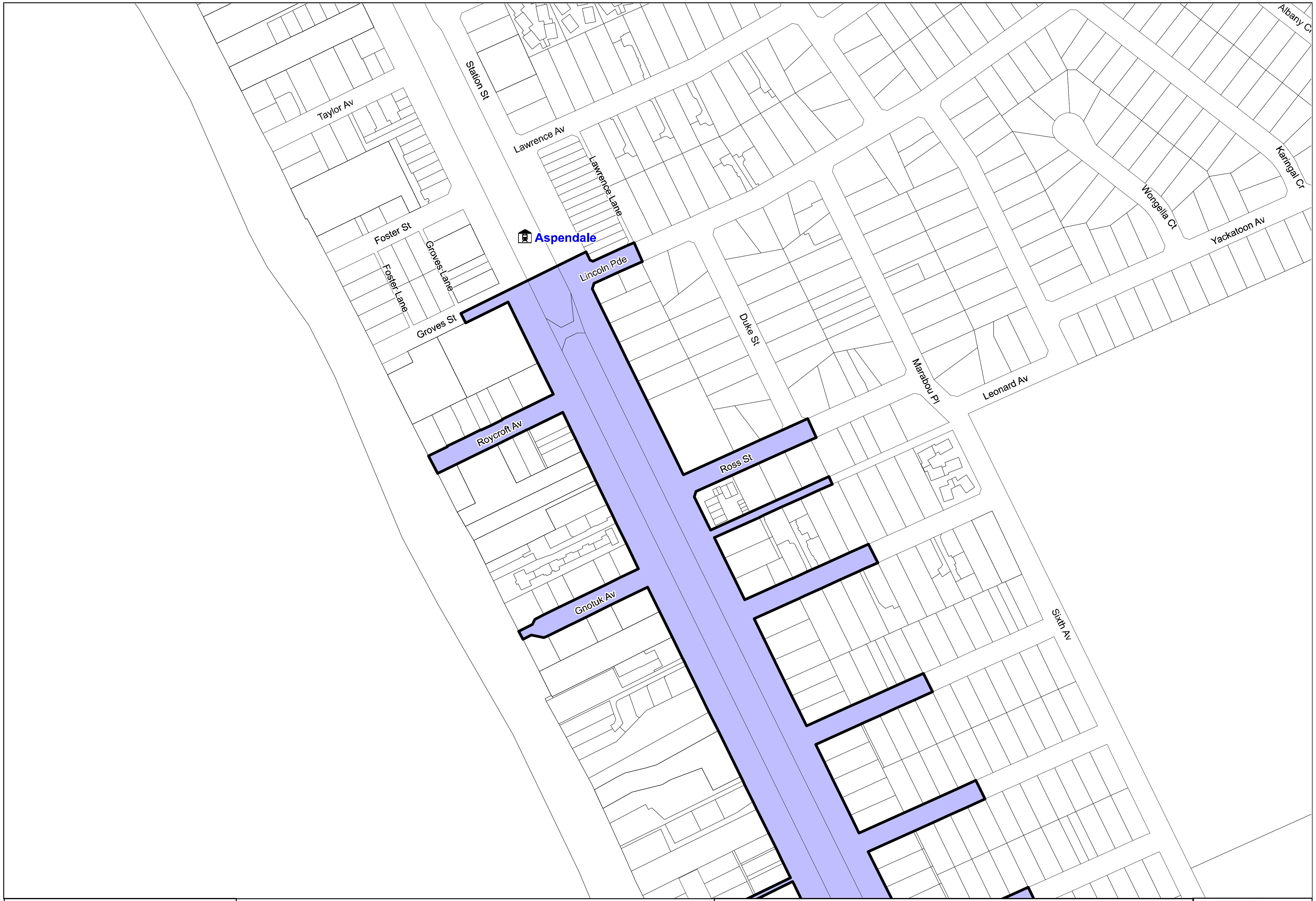
EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA



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0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 1 of 5

Date: 16/02/2018

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LEGEND

▨	Edithvale Road, Edithvale - EES Project Area
🚉	Railway Station
☐	VicMap Cadastre

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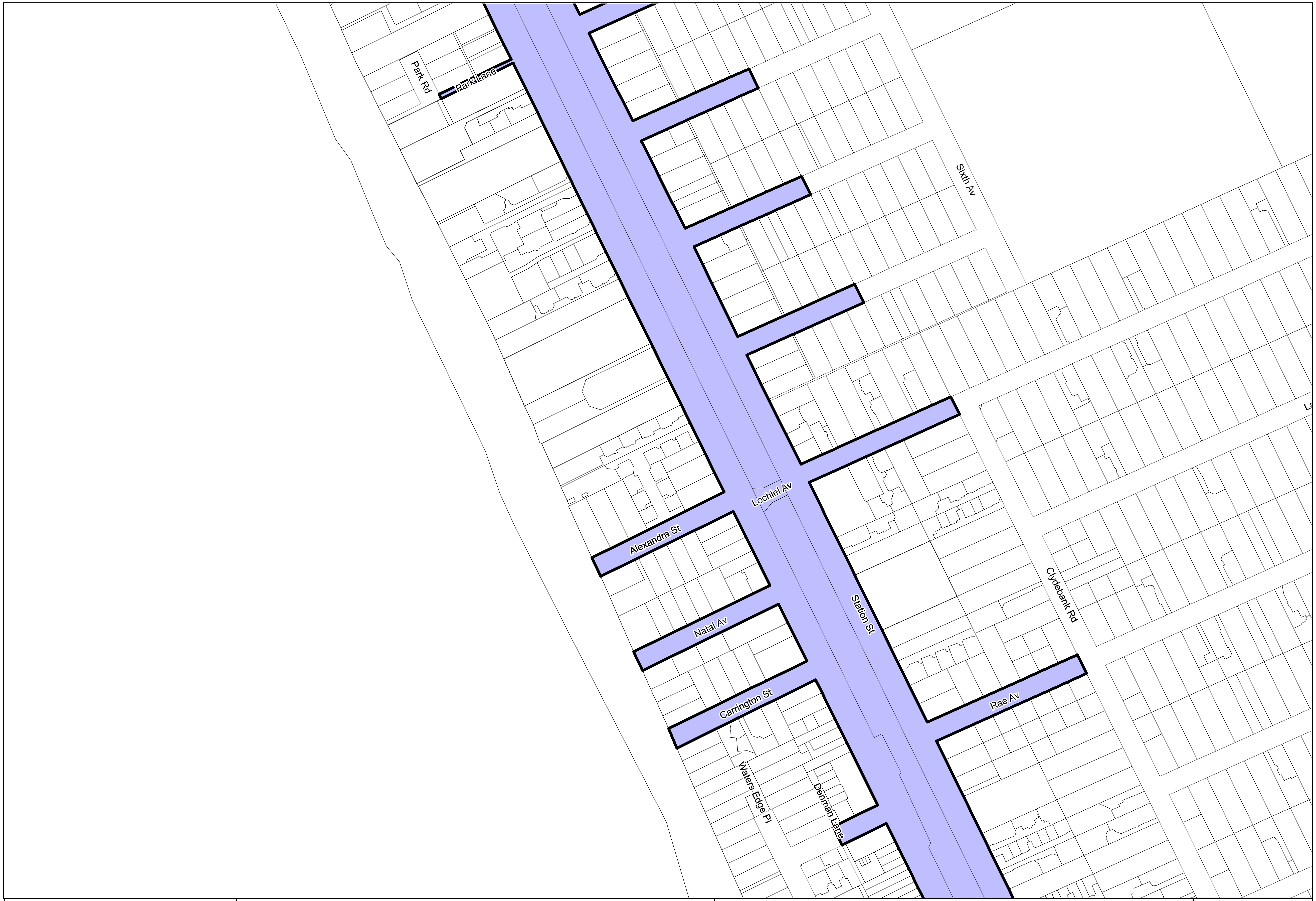
LEVEL CROSSING REMOVAL AUTHORITY



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0 25 50 75 100
Scale 1:2500 @ A3 metres

Sheet 2 of 5 | Date: 16/02/2018

LEGEND

▨ Edithvale Road, Edithvale - EES Project Area

Railway Station

☐ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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LEVEL CROSSING REMOVAL AUTHORITY

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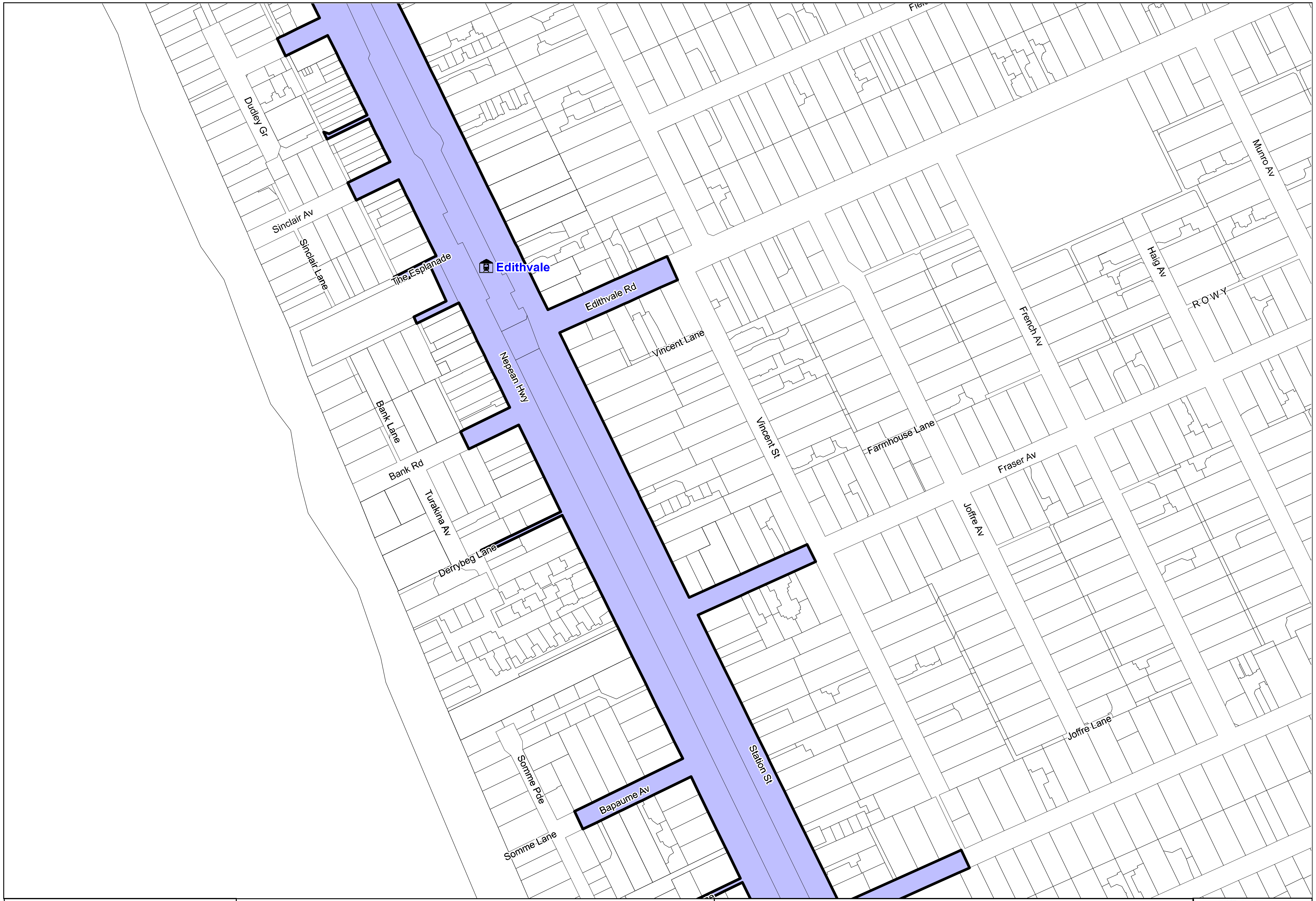

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0 25 50 75 100
Scale 1:2500 @ A3 metres

Sheet 3 of 5

Date: 16/02/2018

X:\Workspaces\Frankston Group\Edithvale Road\Project Area\PSA EES\Version 2\MI V12\EdithvaleRd_Parcel_PPA_v3.WOR

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

Railway Station

▭ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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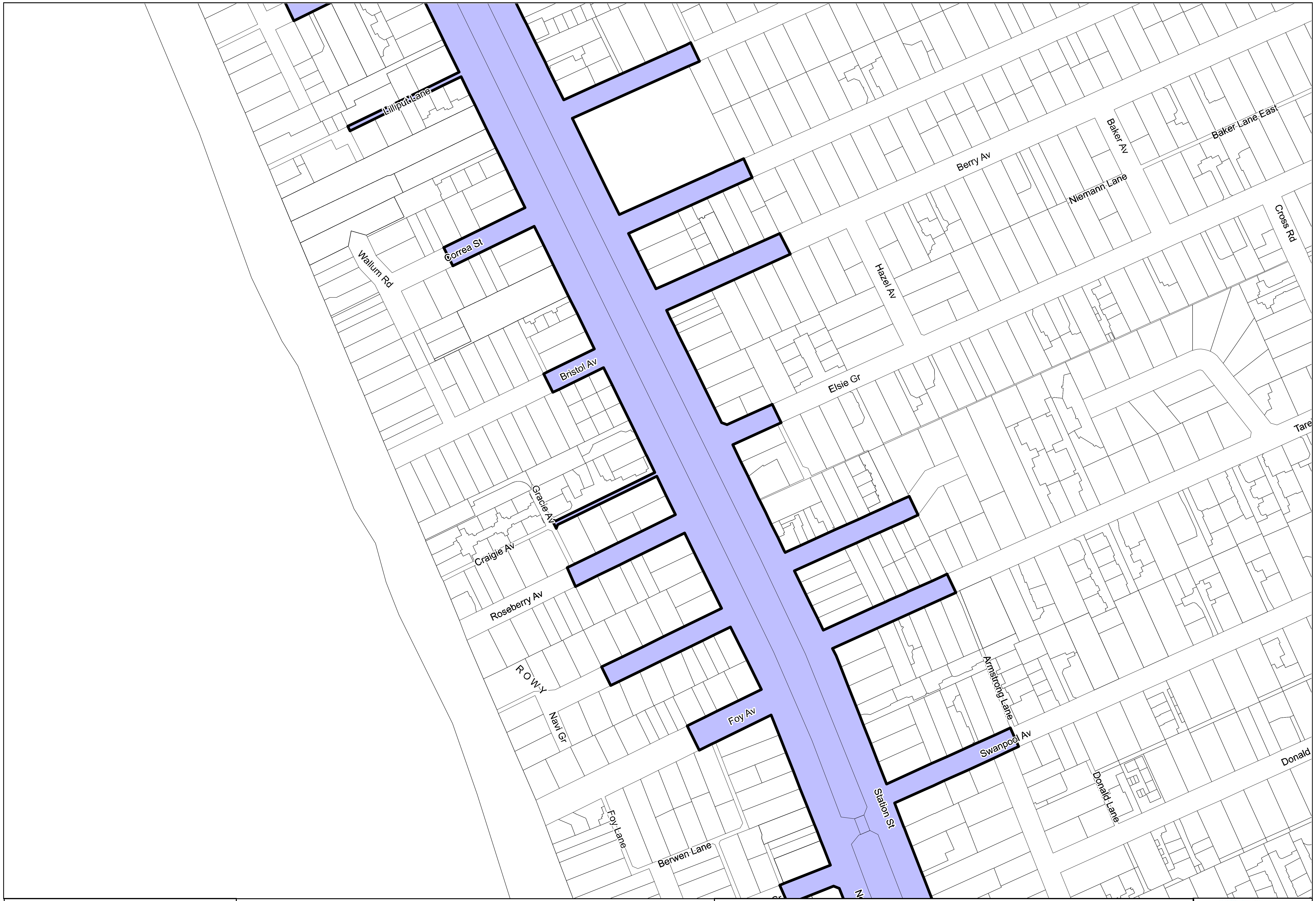
LEVEL
CROSSING
REMOVAL
AUTHORITY

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA



N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 4 of 5 | Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

🚉 Railway Station

▭ VicMap Cadastre

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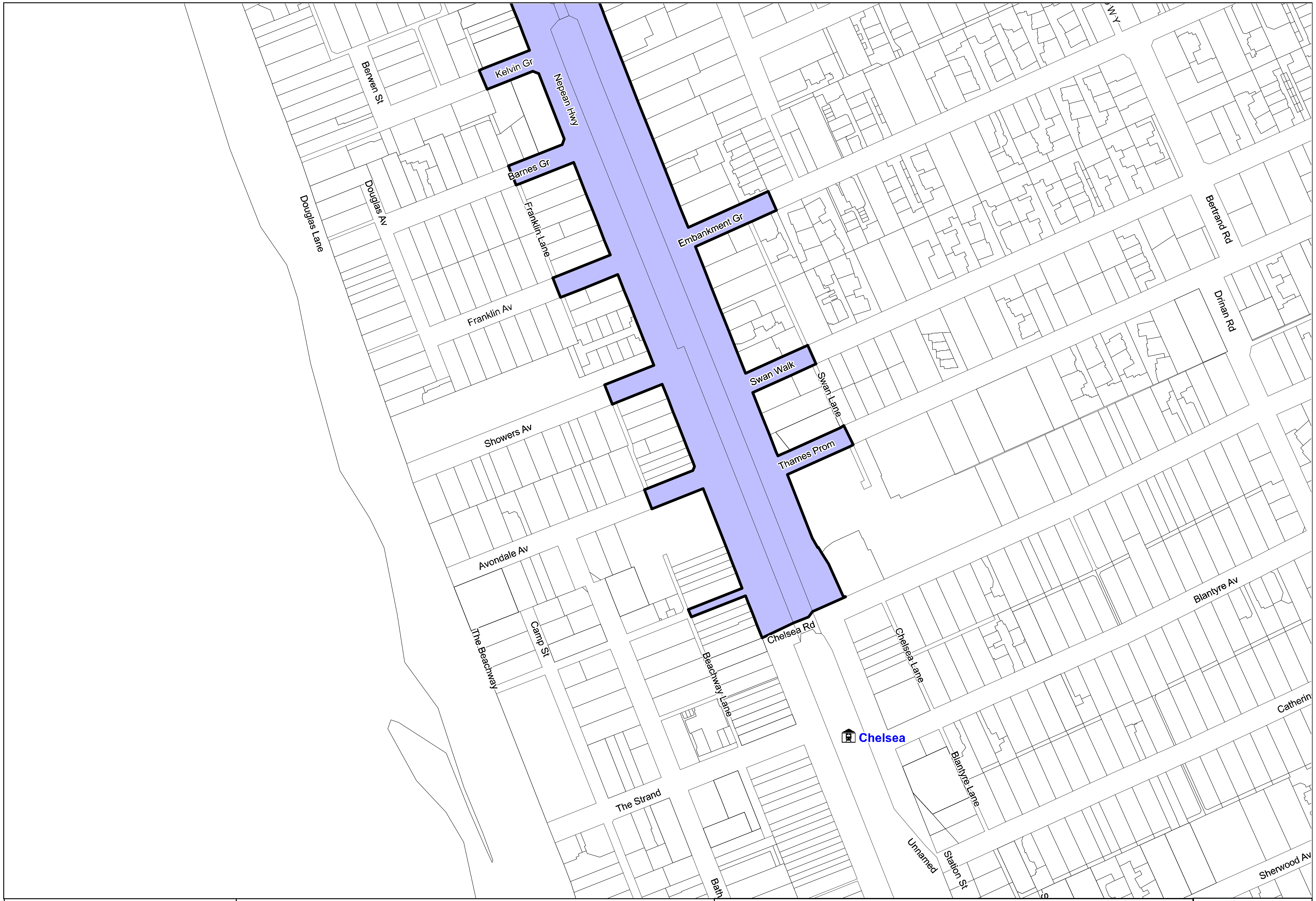

Sheet 5 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

Railway Station

▭ VicMap Cadastre

X:\Workspaces\Frankston Group\Edithvale Road\Project Area\PSA EES\Version 2\MI V12\EdithvaleRd_Parcel_PPA_v3.WOR

EDITHVALE ROAD, EDITHVALE - EES PROJECT AREA

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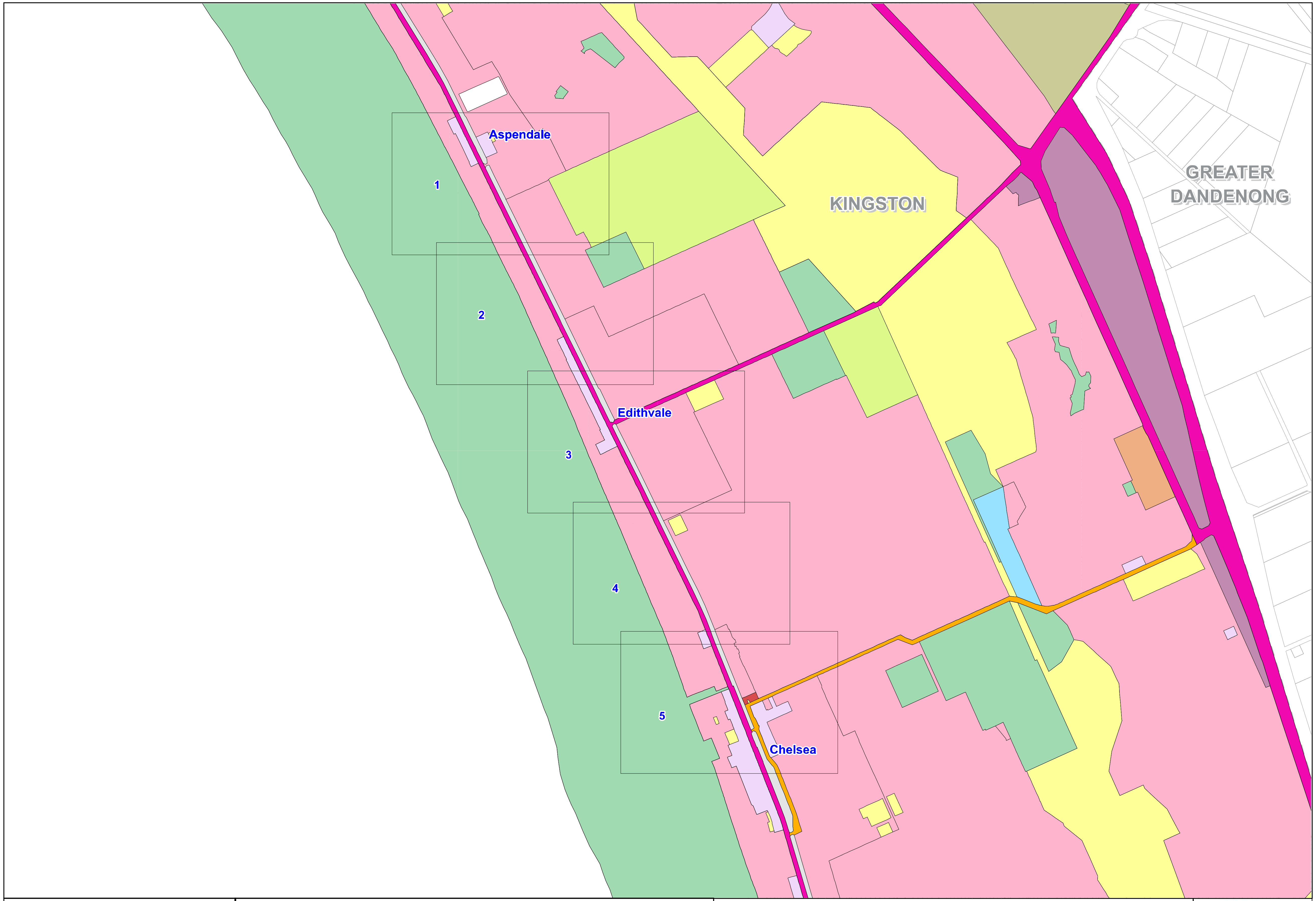
LEVEL CROSSING REMOVAL AUTHORITY



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0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 4 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

Railway Station

☐ VicMap Cadastre

EDITHVALE ROAD, EDITHVALE
PLANNING ZONES

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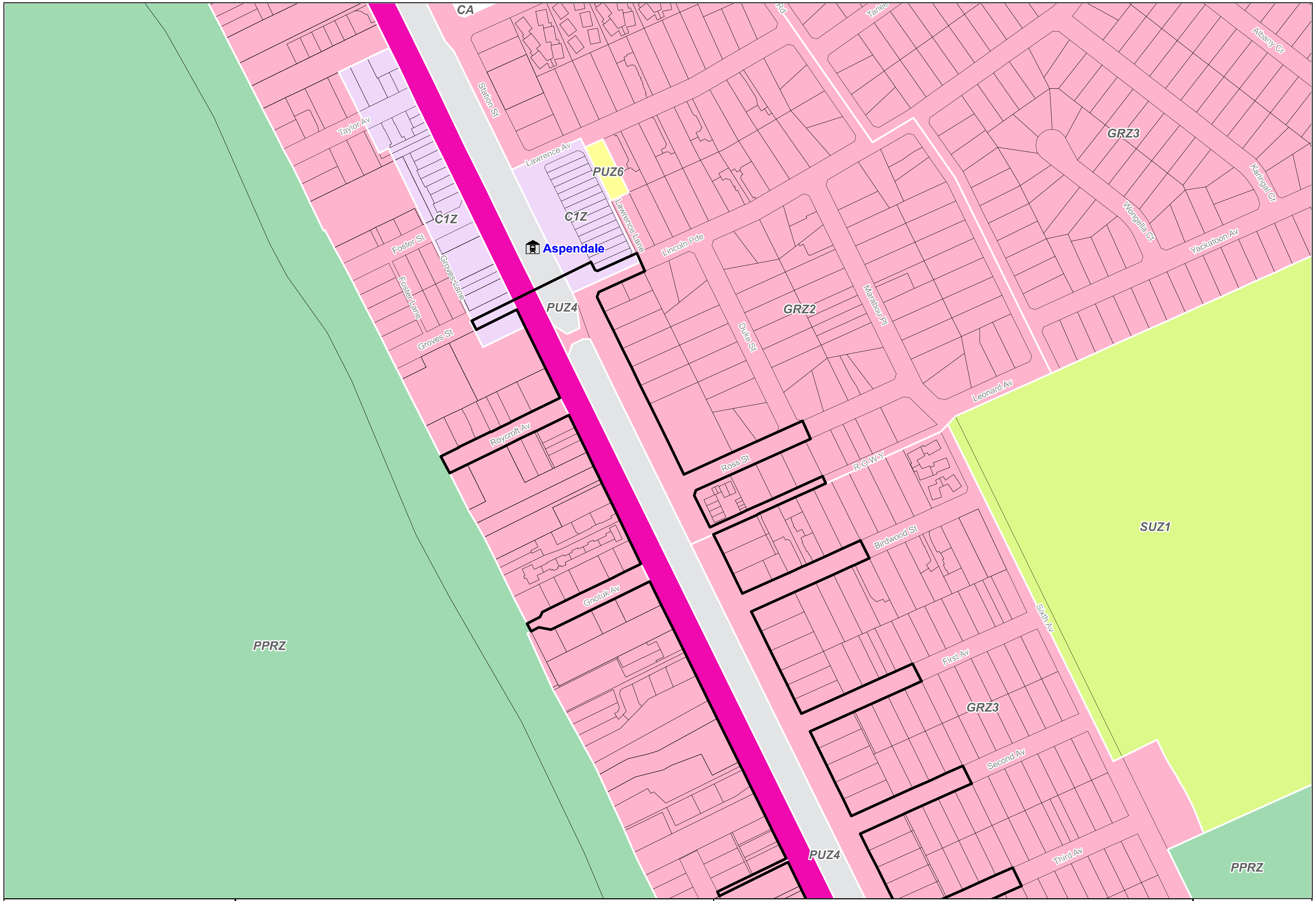

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 1 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Zone

🟪 C1Z	🟩 PPRZ	🟨 PUZ6	🟧 RDZ2
▭ GRZ2	⬜ PUZ4	🟪 RDZ1	🟩 SUZ1
🟥 MUZ			

EDITHVALE ROAD, EDITHVALE PLANNING ZONES

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LEVEL CROSSING REMOVAL AUTHORITY

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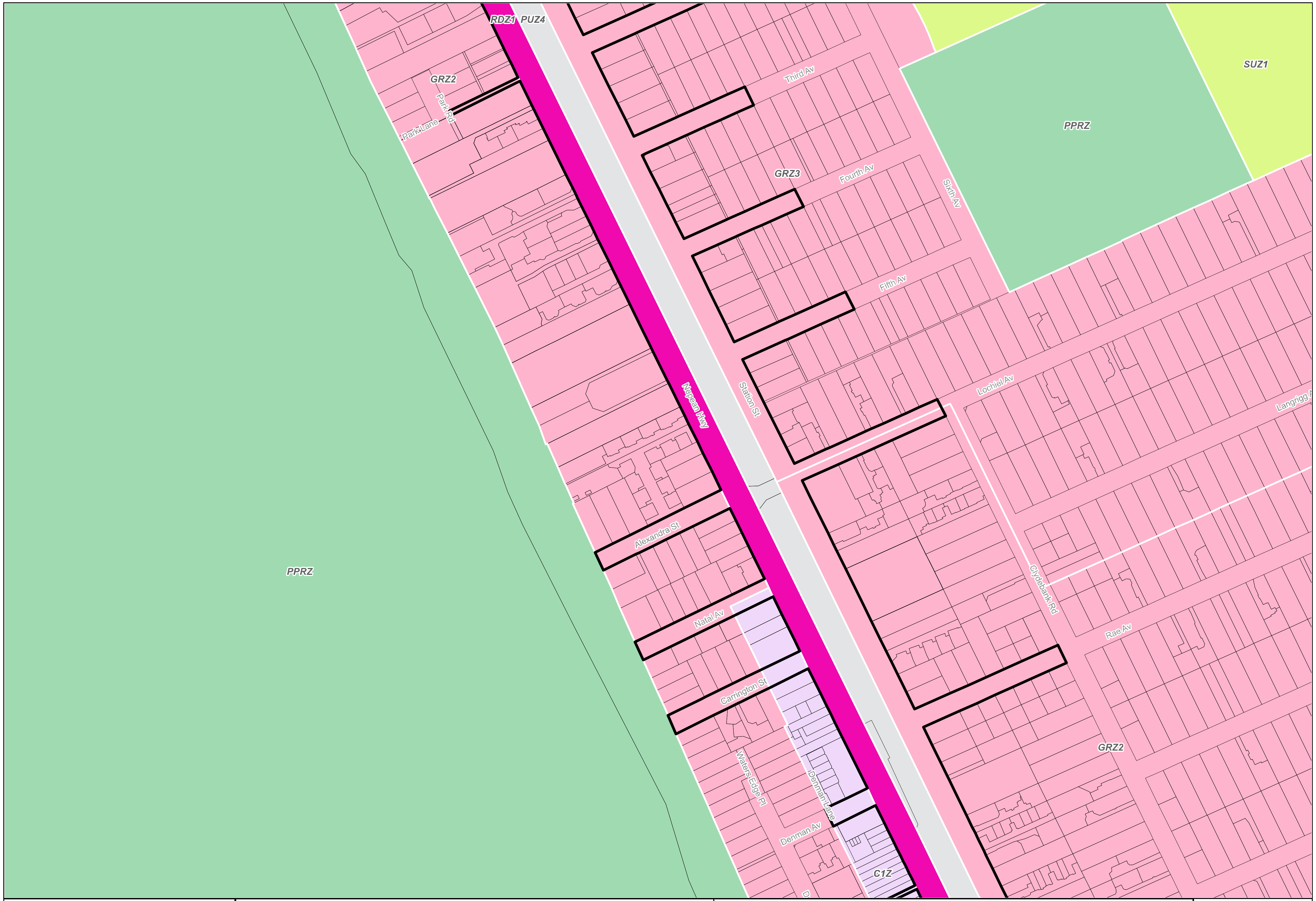

0 25 50 75 100
Scale 1:2500 @ A3 metres

Sheet 2 of 5 Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Zones

C1Z	MUZ	PUZ4	RDZ2
GRZ2	PPRZ	PUZ6	SUZ1
GRZ3	PUZ2	RDZ1	

EDITHVALE ROAD, EDITHVALE PLANNING ZONES

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LEVEL CROSSING REMOVAL AUTHORITY

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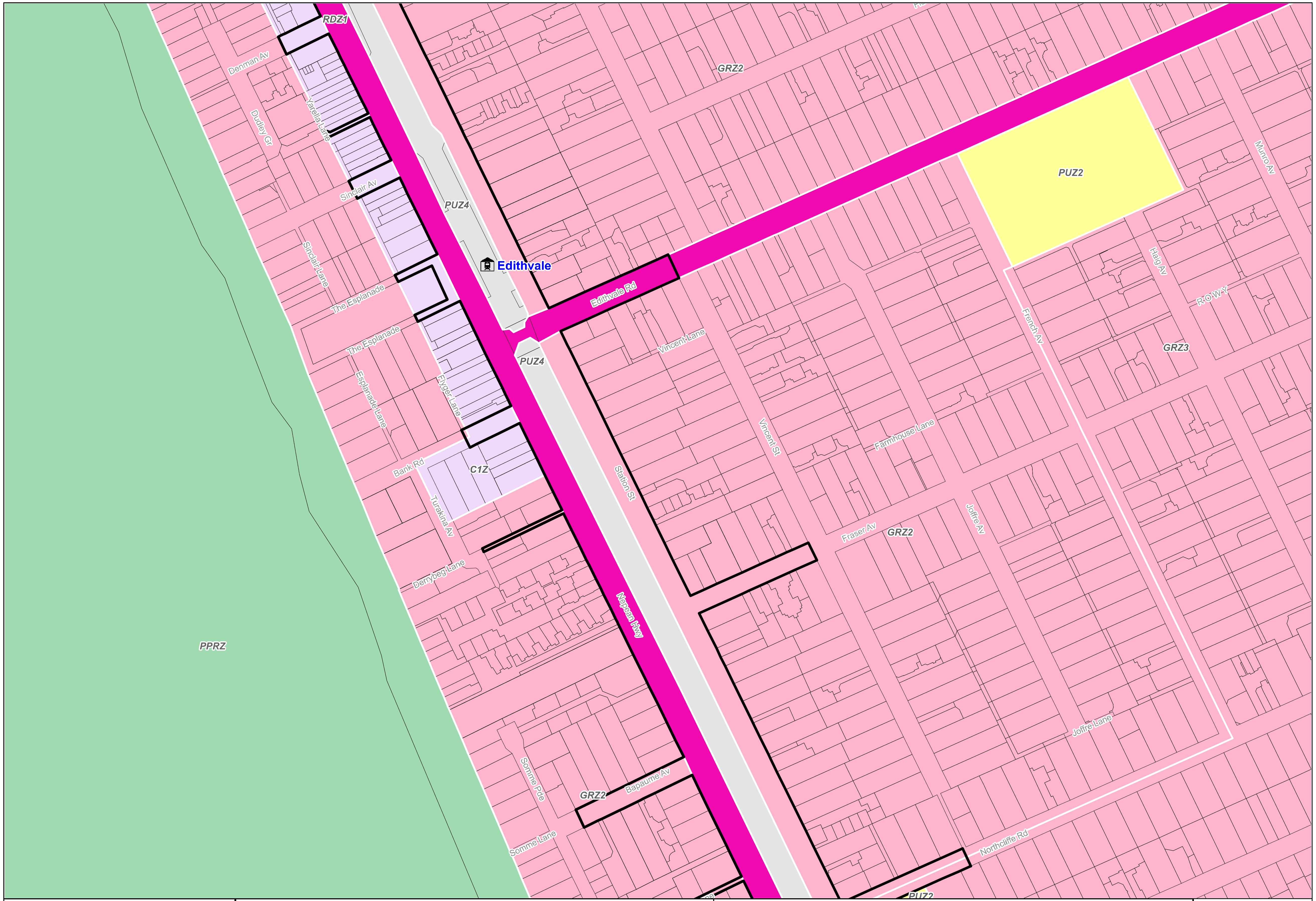

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 3 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

🚉 Railway Station

Planning Zones

🟪 C1Z
■ GRZ2
■ GRZ3
🟥 MUZ
🟩 PPRZ
🟨 PUZ2
⬜ PUZ4
🟨 PUZ6
🟪 RDZ1
🟧 RDZ2
🟩 SUZ1

EDITHVALE ROAD, EDITHVALE
PLANNING ZONES

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LEVEL CROSSING REMOVAL AUTHORITY

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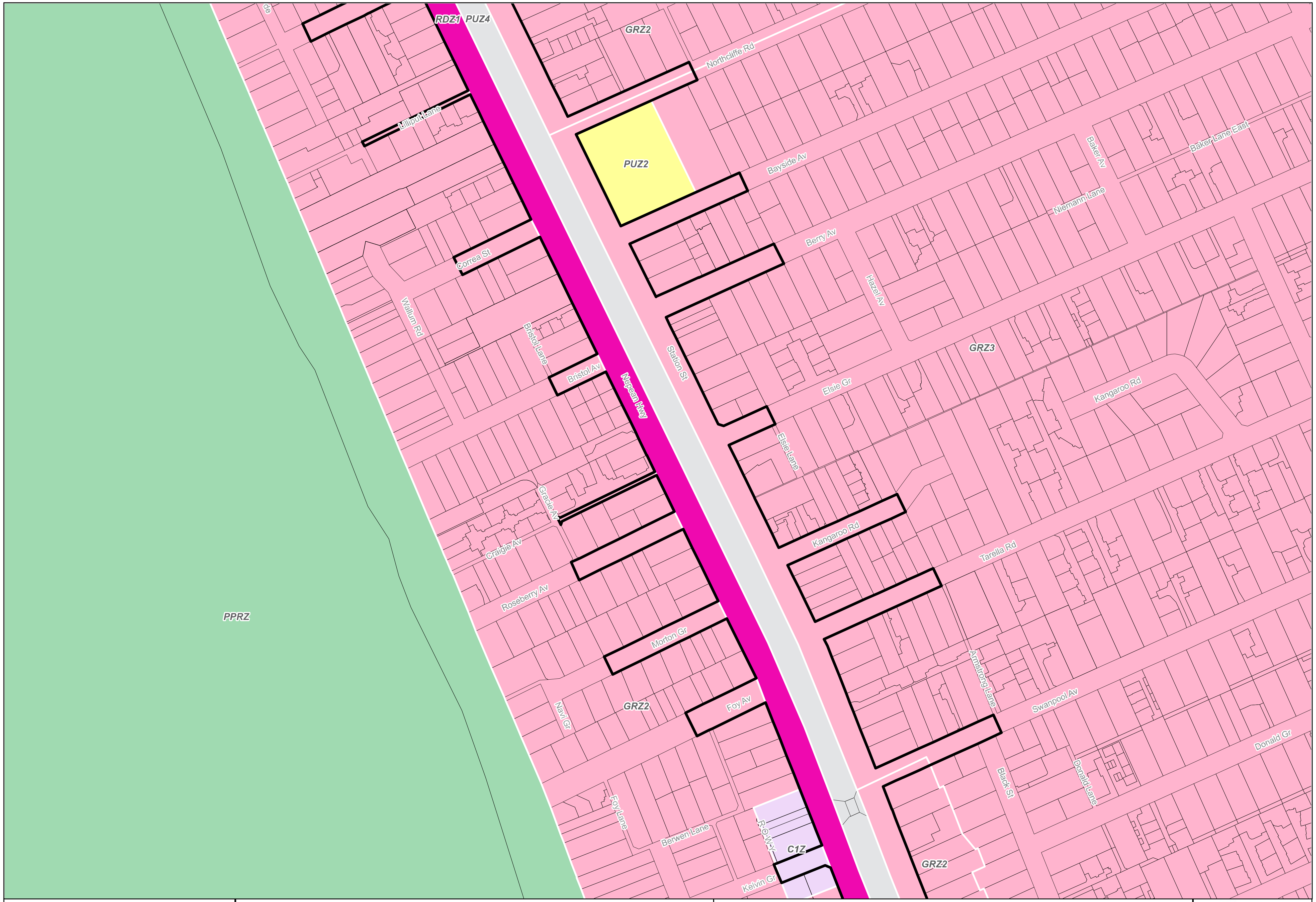

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 4 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Zones

- C1Z
- GRZ2
- GRZ3
- MUZ
- PPRZ
- PUZ2
- PUZ4
- PUZ6
- RDZ1
- RDZ2
- SUZ1

EDITHVALE ROAD, EDITHVALE
PLANNING ZONES

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LEVEL CROSSING REMOVAL AUTHORITY

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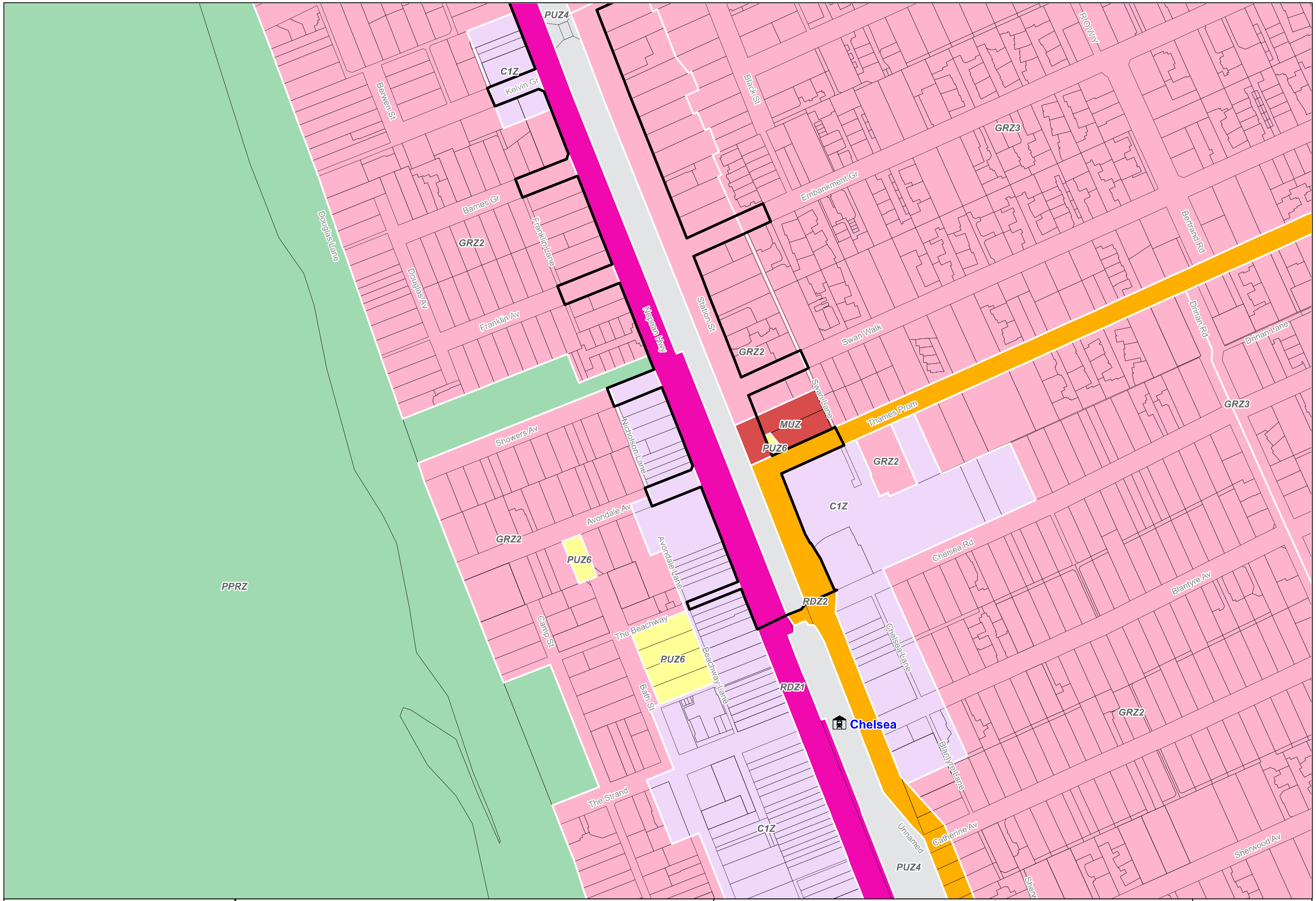

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 5 of 5

Date: 16/02/2018

X:\Workspaces\Frankston Group\Edithvale Road\Project Area\PSA\EdithvaleRd_Zones_PPA_v3.wor

LEGEND

- ▭ Edithvale Road, Edithvale - EES Project Area
- ▭ VicMap Cadastre
- Railway Station

Planning Zones

▭	C1Z	🟥	MUZ	▭	PUZ4	🟧	RDZ2
▭	GRZ2	🟩	PPRZ	🟨	PUZ6	🟩	SUZ1
▭	GRZ3	🟨	PUZ2	🟪	RDZ1		

EDITHVALE ROAD, EDITHVALE
PLANNING ZONES

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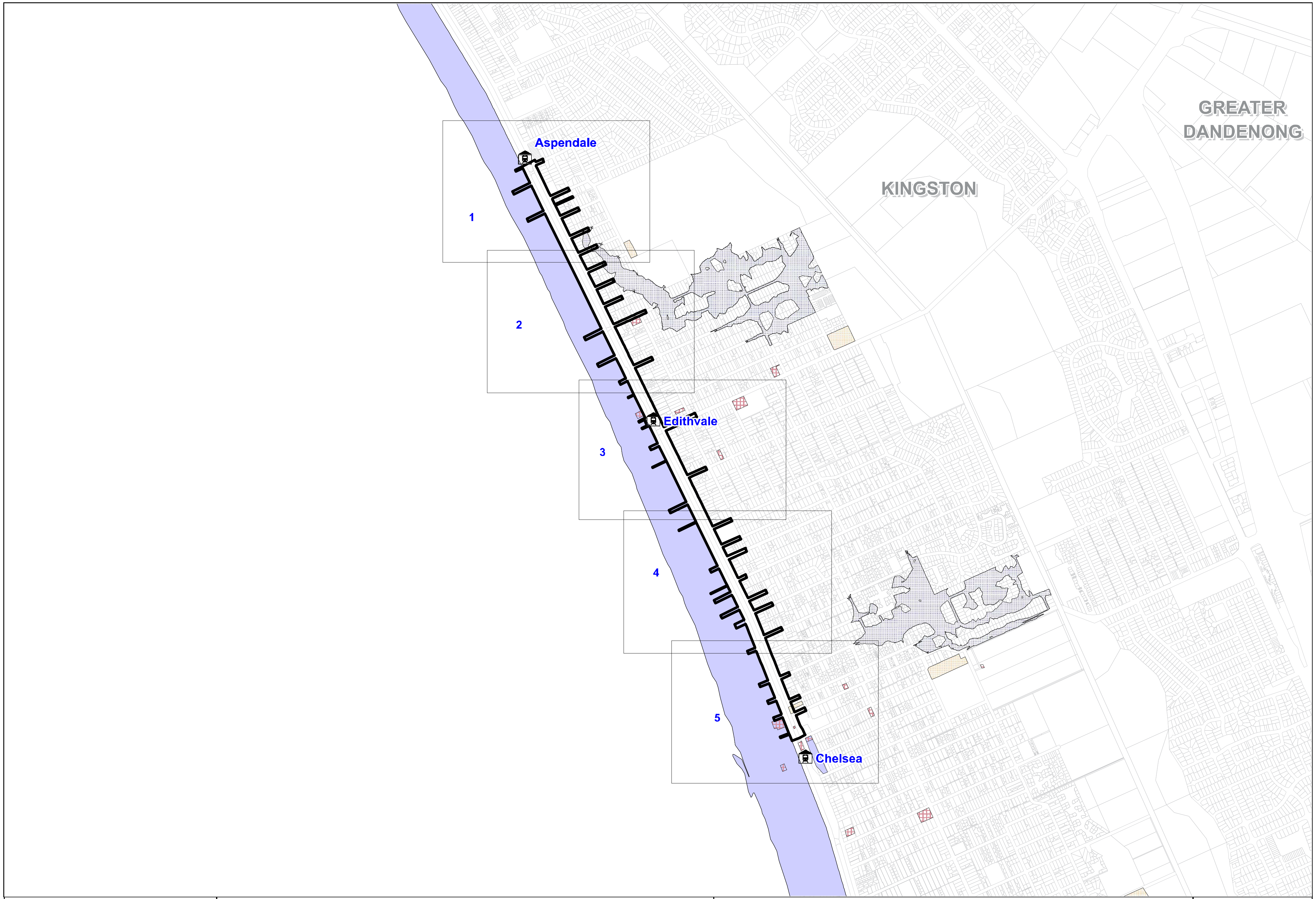
LEVEL CROSSING REMOVAL AUTHORITY



N

0 100 200 300 400
Scale 1:15,000 @ A3 metres

INDEX

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale
- EES Project Area

▭ VicMap Cadastre

🚉 Railway Station

EDITHVALE ROAD, EDITHVALE
PLANNING OVERLAYS

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LEVEL CROSSING REMOVAL AUTHORITY

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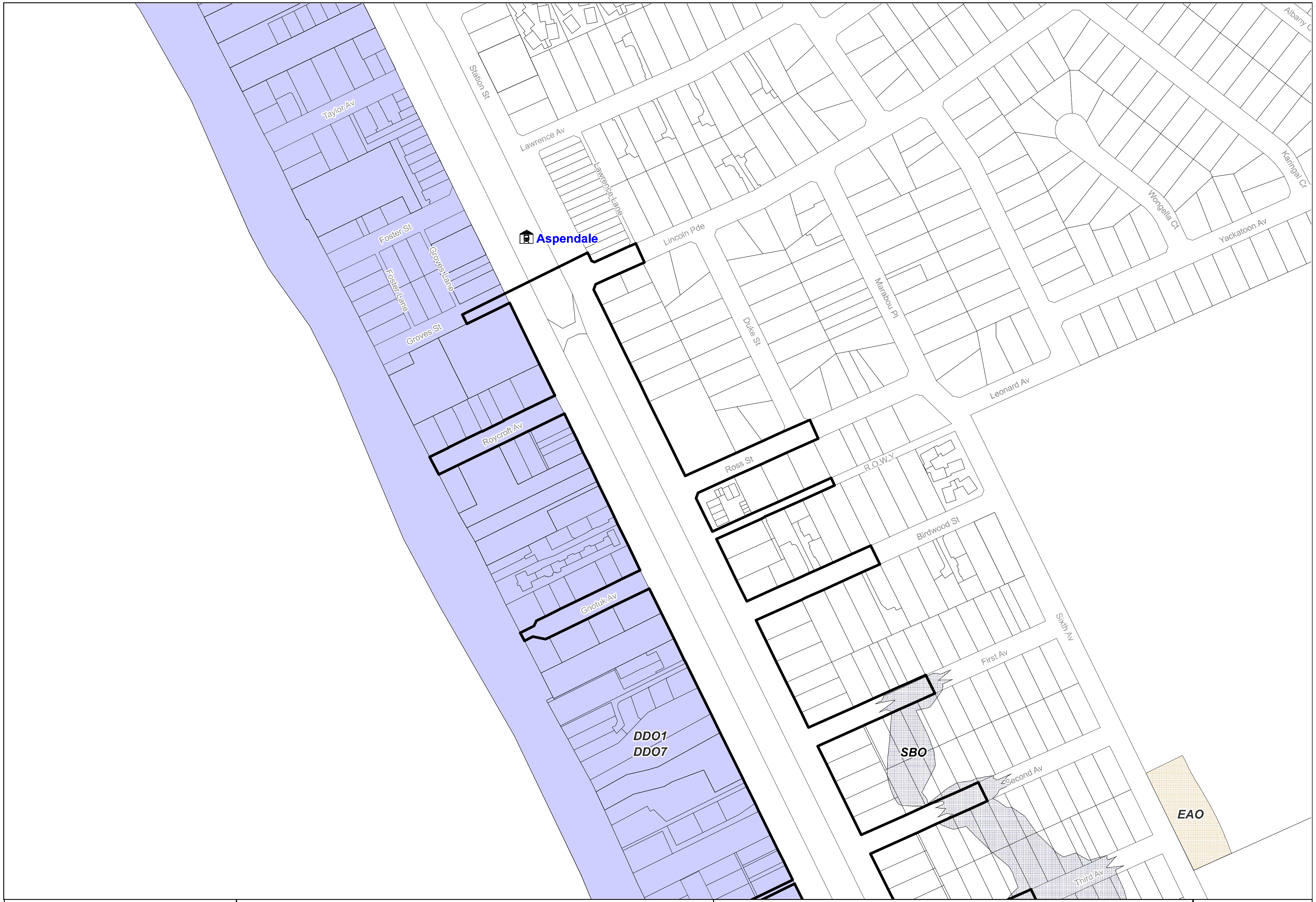
EDITHVALE ROAD, EDITHVALE
PLANNING OVERLAYS



N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 1 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale
- EES Project Area

▭ VicMap Cadastre 🚉 Railway Station

Planning Overlay

▦ HO

🟧 EAO

▦ SBO

🟦 DDO

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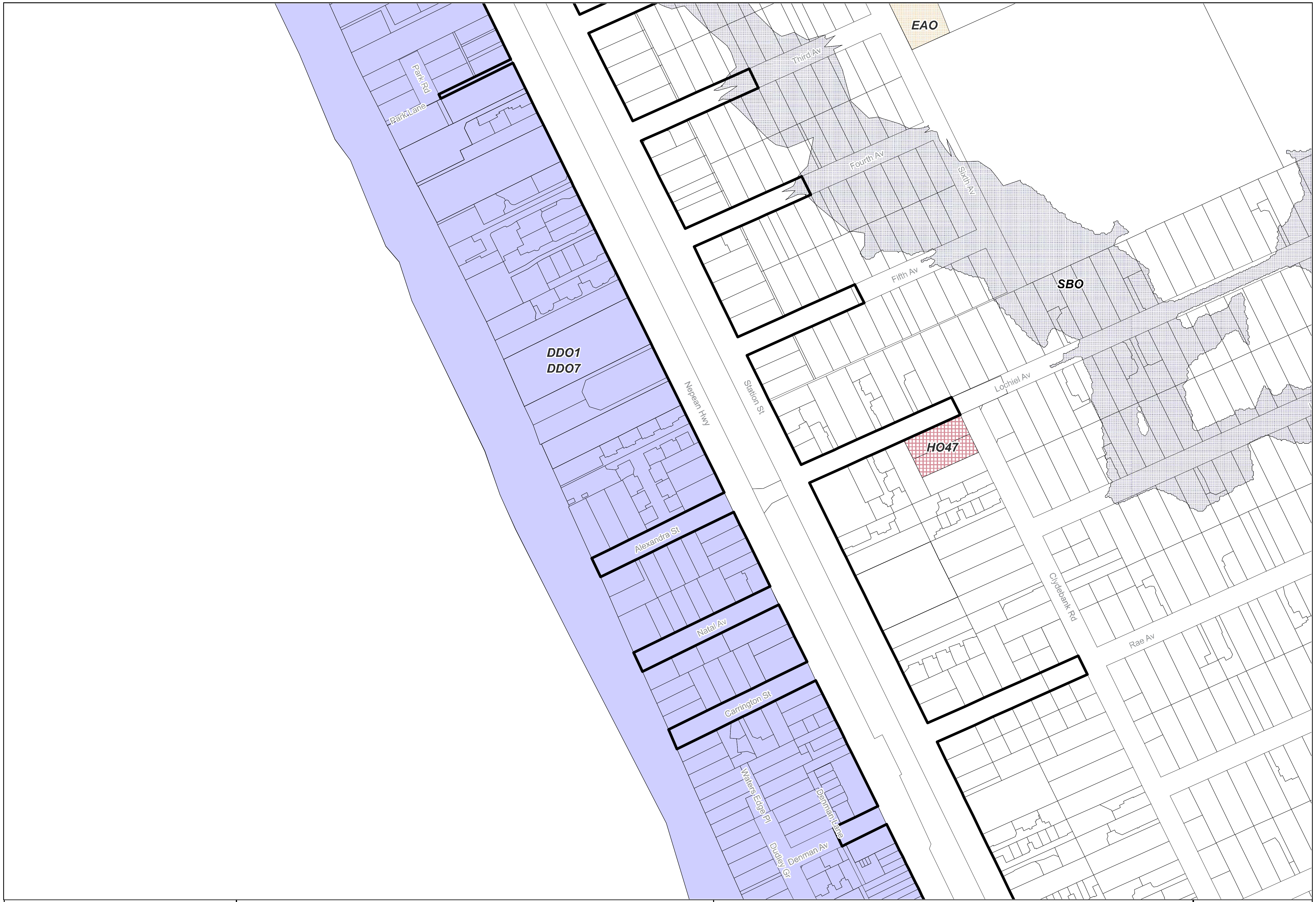

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 2 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Overlay

▨ HO

▨ EAO

▨ SBO

▨ DDO

EDITHVALE ROAD, EDITHVALE
PLANNING OVERLAYS

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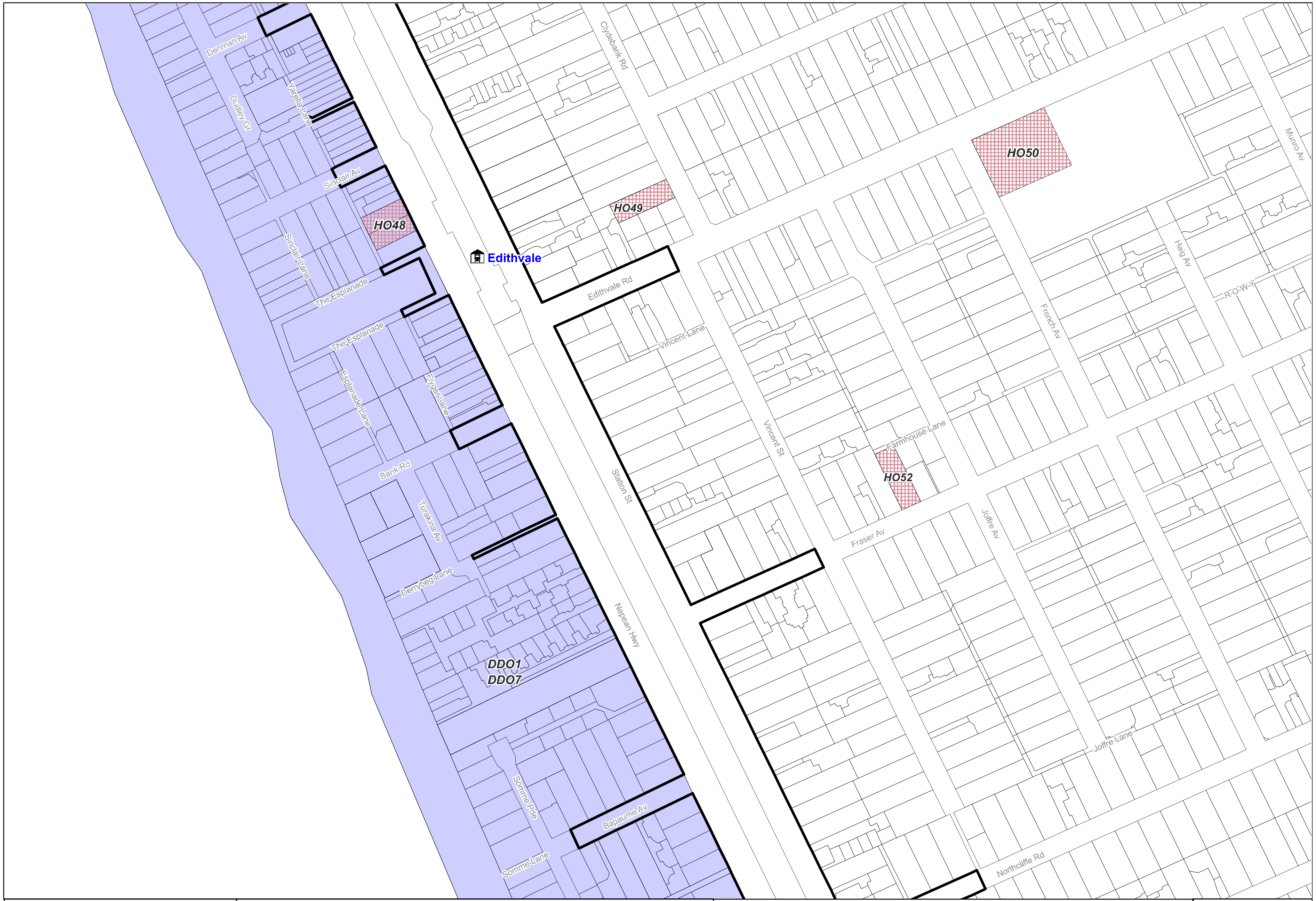

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0 25 50 75 100
Scale 1:2500 @ A3 metres

Sheet 3 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre ⌂ Railway Station

Planning Overlay

▨ HO

▭ EAO

▨ SBO

▭ DDO

EDITHVALE ROAD, EDITHVALE
PLANNING OVERLAYS

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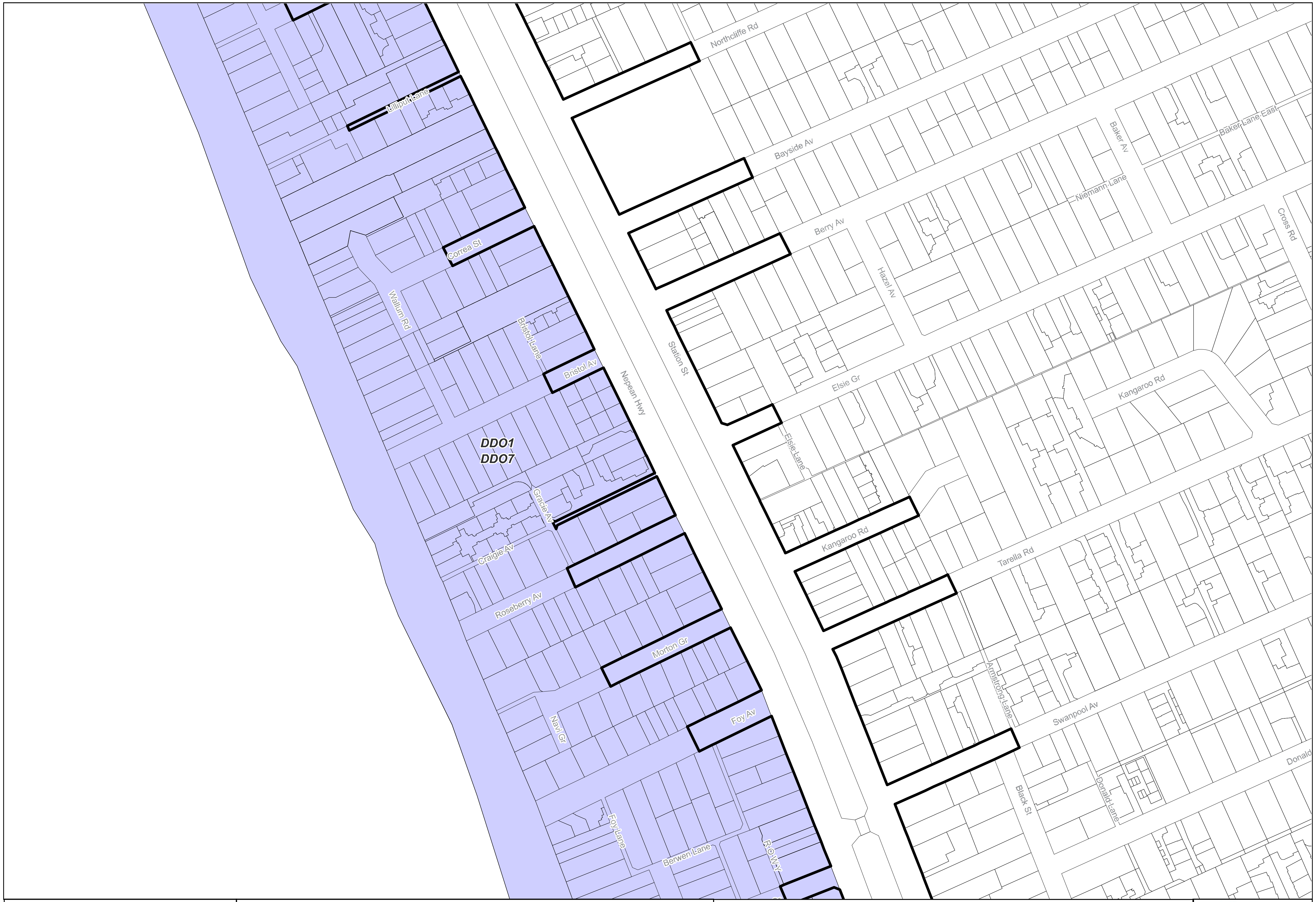

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 4 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Overlay

▨ HO

▨ EAO

▨ SBO

🟦 DDO

EDITHVALE ROAD, EDITHVALE PLANNING OVERLAYS

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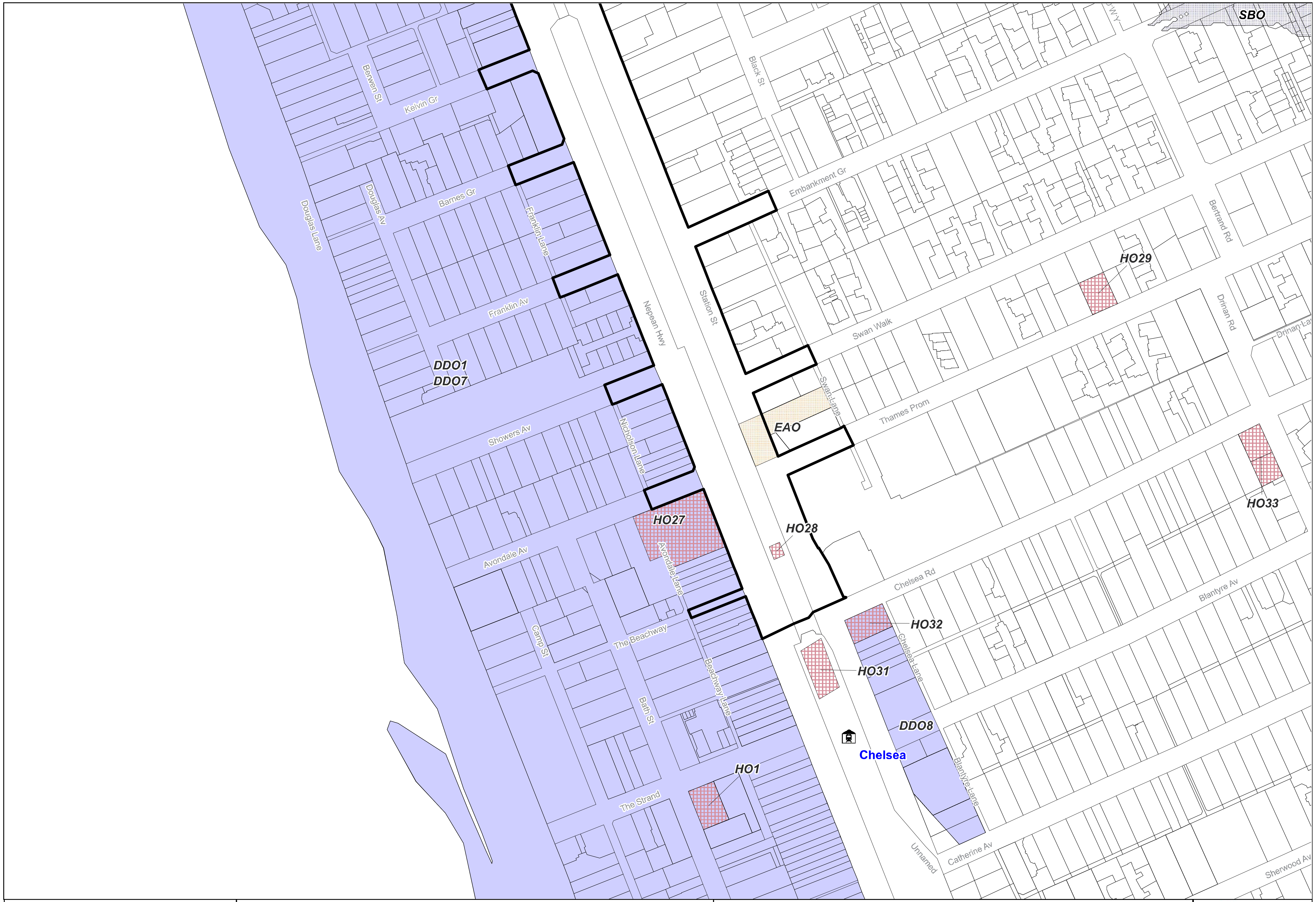

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 5 of 5

Date: 16/02/2018

LEGEND

▭ Edithvale Road, Edithvale - EES Project Area

▭ VicMap Cadastre

🚉 Railway Station

Planning Overlay

▨ HO

▭ EAO

▨ SBO

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EDITHVALE ROAD, EDITHVALE PLANNING OVERLAYS

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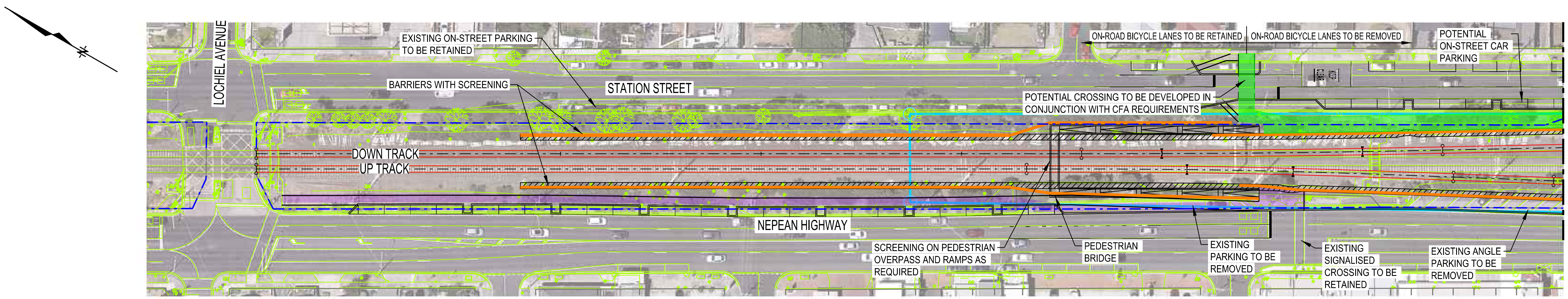
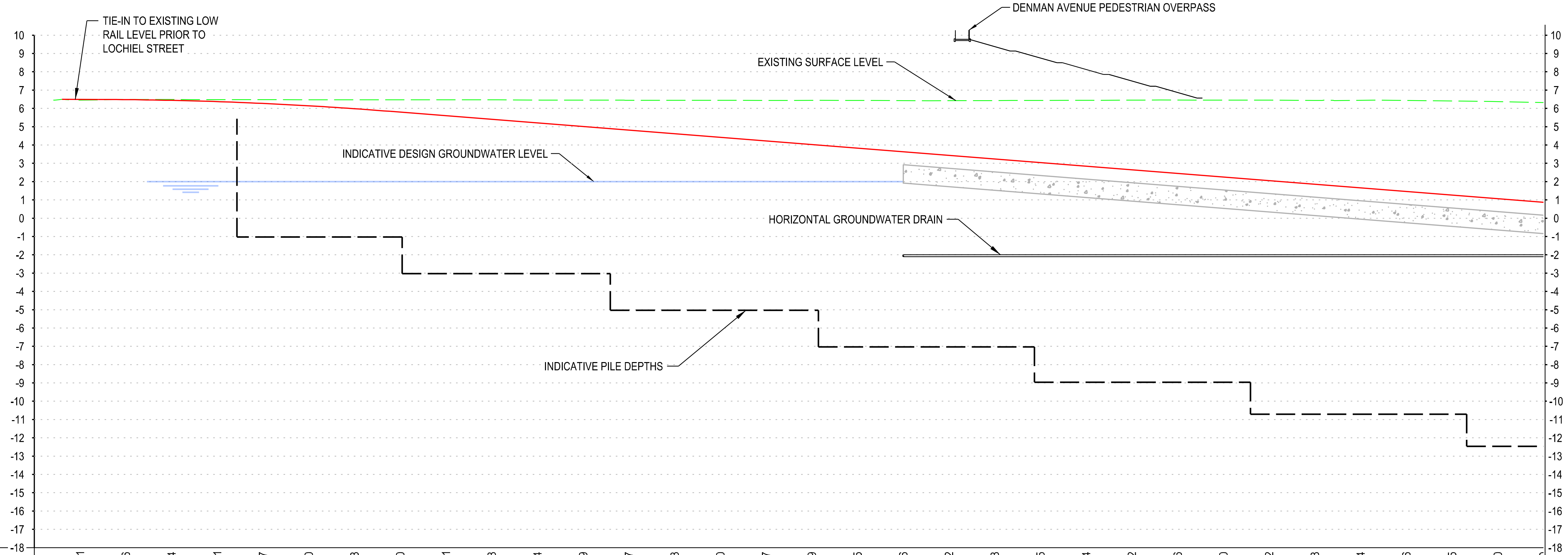

LOCHIEL AVENUE
EXISTING ON-STREET PARKING TO BE RETAINED
BARRIERS WITH SCREENING
STATION STREET
DOWN TRACK
UP TRACK
NEPEAN HIGHWAY
ON-ROAD BICYCLE LANES TO BE RETAINED
ON-ROAD BICYCLE LANES TO BE REMOVED
POTENTIAL ON-STREET CAR PARKING
POTENTIAL CROSSING TO BE DEVELOPED IN CONJUNCTION WITH CFA REQUIREMENTS
SCREENING ON PEDESTRIAN OVERPASS AND RAMPS AS REQUIRED
PEDESTRIAN BRIDGE
EXISTING PARKING TO BE REMOVED
EXISTING SIGNALISED CROSSING TO BE RETAINED
EXISTING ANGLE PARKING TO BE REMOVED

CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3042

PLAN VIEW
SCALE 1:1000


DENMAN AVENUE PEDESTRIAN OVERPASS
TIE-IN TO EXISTING LOW RAIL LEVEL PRIOR TO LOCHIEL STREET
EXISTING SURFACE LEVEL
INDICATIVE DESIGN GROUNDWATER LEVEL
HORIZONTAL GROUNDWATER DRAIN
INDICATIVE PILE DEPTHS
10
9
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18

EXISTING TRACK LEVEL (m)	6.451	6.486	6.484	6.481	6.477	6.470	6.468	6.470	6.471	6.468	6.454	6.449	6.447	6.443	6.440	6.437	6.439	6.435	6.426	6.422	6.428	6.435	6.444	6.452	6.456	6.450	6.452	6.438	6.444	6.436	6.405	6.370
PROPOSED TRACK LEVEL (m)	6.491	6.479	6.440	6.371	6.272	6.143	5.984	5.796	5.599	5.402	5.205	5.008	4.811	4.614	4.417	4.220	4.023	3.826	3.629	3.432	3.235	3.038	2.841	2.644	2.447	2.250	2.053	1.856	1.659	1.462	1.265	1.068

RAIL LONGITUDINAL SECTION
SCALE 1:1000(H) ; 1:250(V)

PRELIMINARY

No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Designer	Design Check	Date
A	ISSUED FOR INFORMATION ONLY	DF	CA	HN	06.02.18

HORIZONTAL SCALE
0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

VERTICAL SCALE
0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

AECOM GHD
JOINT VENTURE
Collins Square, Level 10, Tower 2, 727 Collins Street,
Melbourne, VIC 3008, Australia
T +61 3 9653 1234 F +61 3 9654 7117
ABN: 57 194 323 595

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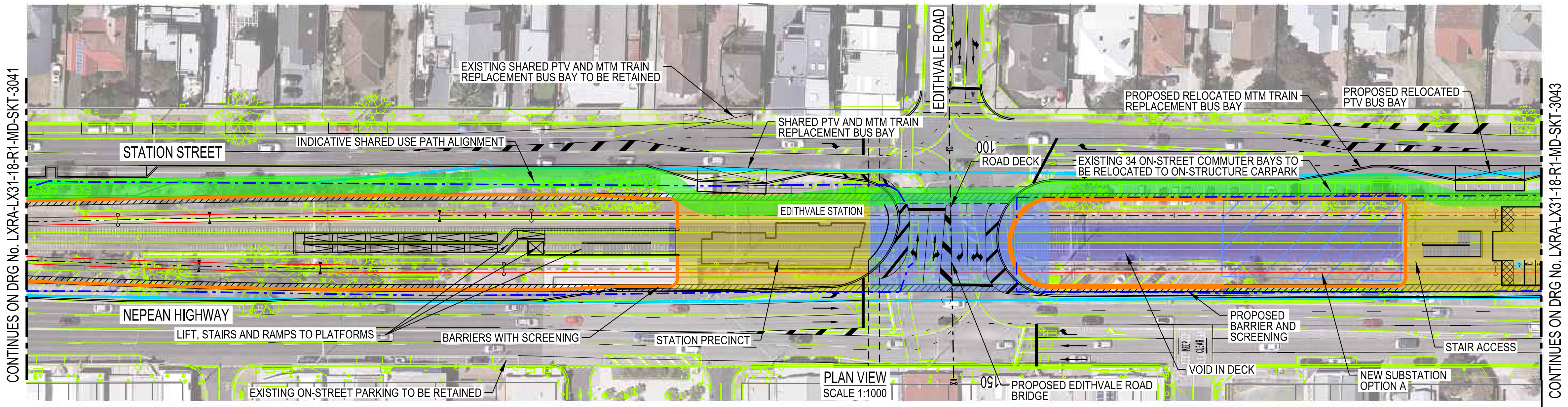
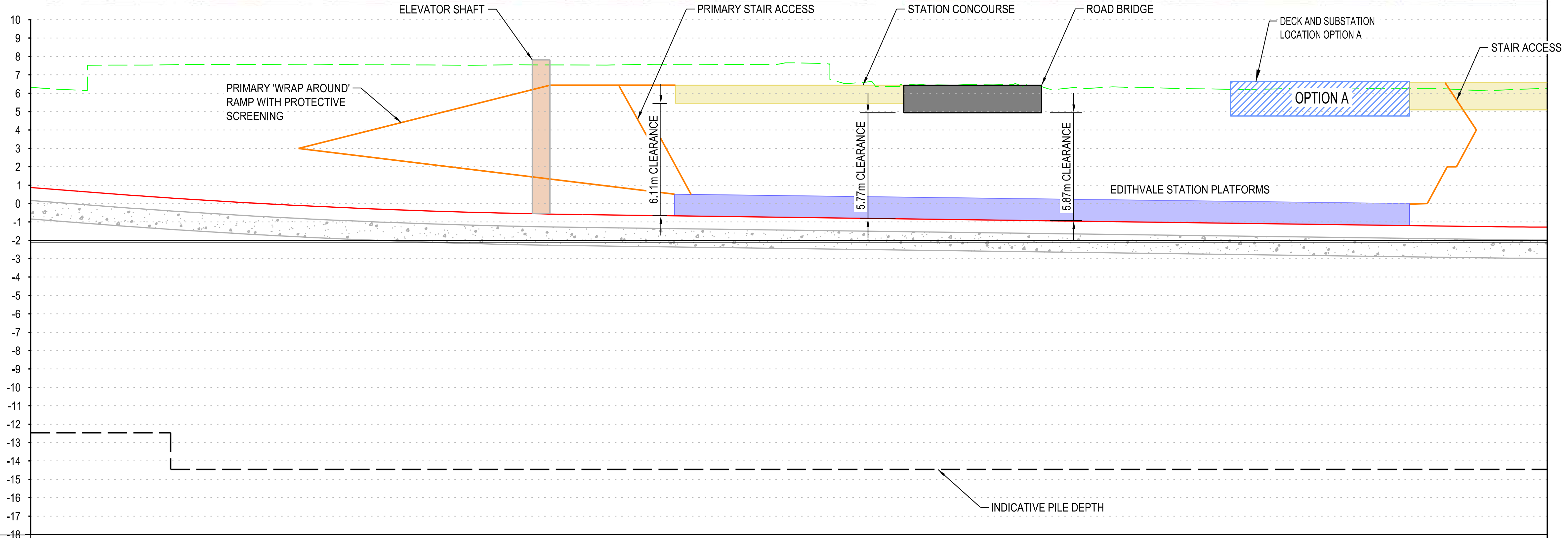
Drawn A.TAN
Designer C.AU
Drafting Check D.FRANCIS
Design Check H.NGUYEN
Approved (Project Manager)
Date
Scale AS SHOWN
This Drawing must not be used for Construction unless signed as Approved

Client LEVEL CROSSING REMOVAL AUTHORITY
Project LX31 - SITE 18 - EDITHVALE ROAD, EDITHVALE
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 1 OF 4
Original Size A3 Drg No: LXRA-LX31-18-R1-MD-SKT-3041 Rev: A


CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3041
EXISTING SHARED PTV AND MTM TRAIN REPLACEMENT BUS BAY TO BE RETAINED
STATION STREET
INDICATIVE SHARED USE PATH ALIGNMENT
SHARED PTV AND MTM TRAIN REPLACEMENT BUS BAY
EDITHVALE ROAD
EDITHVALE STATION
ROAD DECK
100
PROPOSED RELOCATED MTM TRAIN REPLACEMENT BUS BAY
PROPOSED RELOCATED PTV BUS BAY
EXISTING 34 ON-STREET COMMUTER BAYS TO BE RELOCATED TO ON-STRUCTURE CARPARK
NEPEAN HIGHWAY
LIFT, STAIRS AND RAMPS TO PLATFORMS
BARRIERS WITH SCREENING
STATION PRECINCT
EXISTING ON-STREET PARKING TO BE RETAINED
150
PROPOSED EDITHVALE ROAD BRIDGE
PROPOSED BARRIER AND SCREENING
VOID IN DECK
NEW SUBSTATION OPTION A
STAIR ACCESS
CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3043

PLAN VIEW
SCALE 1:1000



EXISTING TRACK LEVEL (m)	6.320	6.173	7.531	7.552	7.563	7.555	7.552	7.556	7.546	7.529	7.533	7.544	7.538	7.552	7.575	7.567	7.557	7.629	6.569	6.414	6.449	6.458	6.358	6.263	6.325	6.254	6.219	6.234	6.236	6.249	6.268	6.212	6.170
PROPOSED TRACK LEVEL (m)	0.871	0.674	0.484	0.308	0.148	0.003	-0.128	-0.243	-0.344	-0.429	-0.500	-0.556	-0.597	-0.630	-0.663	-0.697	-0.730	-0.763	-0.797	-0.830	-0.863	-0.896	-0.930	-0.963	-0.996	-1.030	-1.063	-1.096	-1.130	-1.163	-1.196	-1.229	-1.262

RAIL LONGITUDINAL SECTION
SCALE 1:1000(H) ; 1:250(V)

PRELIMINARY

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HORIZONTAL SCALE
0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

VERTICAL SCALE
0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

AECOM GHD
JOINT VENTURE
Collins Square, Level 10, Tower 2, 727 Collins Street,
Melbourne, VIC 3008, Australia
T +61 3 9653 1234 **F** +61 3 9654 7117
ABN: 57 194 323 595

LEVEL CROSSING REMOVAL AUTHORITY

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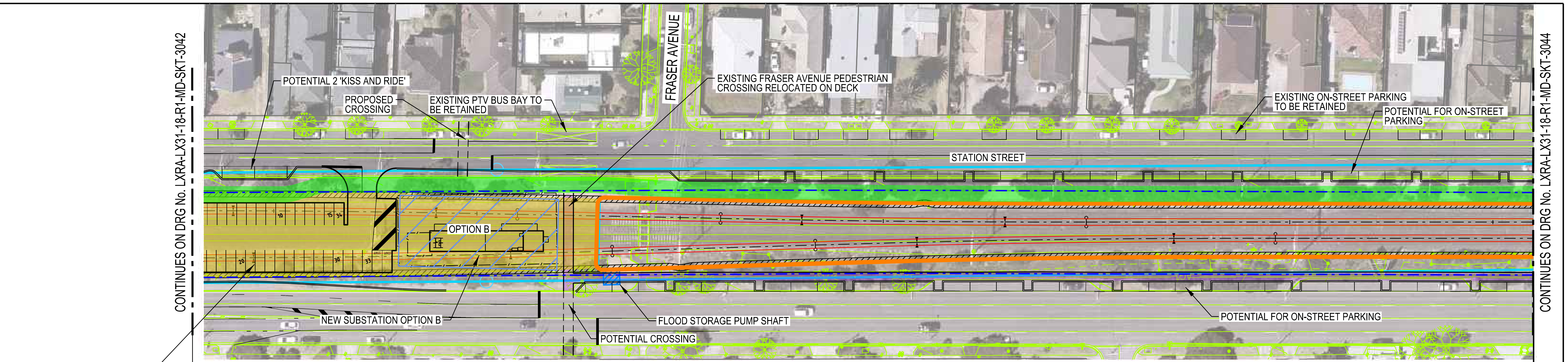
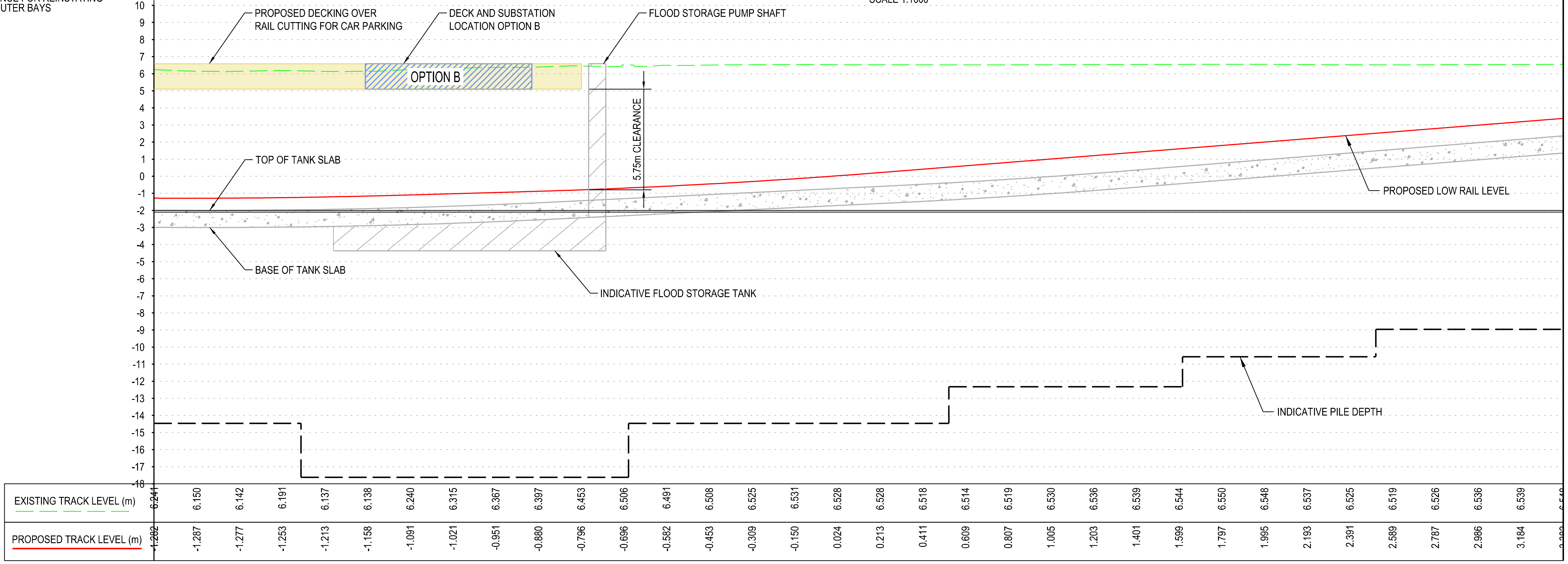
Drawn A.TAN
Designer C.AU
Drafting Check D.FRANCIS
Design Check H.NGUYEN
Approved (Project Manager)
Date
Scale AS SHOWN
This Drawing must not be used for Construction unless signed as Approved

Client LEVEL CROSSING REMOVAL AUTHORITY
Project LX31 - SITE 18 - EDITHVALE ROAD, EDITHVALE
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 2 OF 4
Original Size **A3** Drg No: LXRA-LX31-18-R1-MD-SKT-3042 Rev: A


CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3042
POTENTIAL 2 'KISS AND RIDE'
PROPOSED CROSSING
EXISTING PTV BUS BAY TO BE RETAINED
FRASER AVENUE
EXISTING FRASER AVENUE PEDESTRIAN CROSSING RELOCATED ON DECK
EXISTING ON-STREET PARKING TO BE RETAINED
POTENTIAL FOR ON-STREET PARKING
STATION STREET
OPTION B
NEW SUBSTATION OPTION B
FLOOD STORAGE PUMP SHAFT
POTENTIAL CROSSING
POTENTIAL FOR ON-STREET PARKING
CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3044
ON STRUCTURE CAR PARKING (ALLOWANCE FOR REINSTATING 34 COMMUTER BAYS)

PLAN VIEW
SCALE 1:1000



EXISTING TRACK LEVEL (m)	6.241	6.150	6.142	6.191	6.137	6.138	6.240	6.315	6.367	6.397	6.453	6.506	6.491	6.508	6.525	6.531	6.528
PROPOSED TRACK LEVEL (m)	-1.282	-1.287	-1.277	-1.253	-1.213	-1.158	-1.091	-1.021	-0.951	-0.880	-0.796	-0.696	-0.582	-0.453	-0.309	-0.150	0.024

EXISTING TRACK LEVEL (m)	6.528	6.518	6.514	6.519	6.530	6.536	6.539	6.544	6.550	6.548	6.537	6.525	6.519	6.526	6.536	6.539
PROPOSED TRACK LEVEL (m)	0.213	0.411	0.609	0.807	1.005	1.203	1.401	1.599	1.797	1.995	2.193	2.391	2.589	2.787	2.986	3.184

RAIL LONGITUDINAL SECTION
SCALE 1:1000(H) ; 1:250(V)

PRELIMINARY

No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Designer	Design Check	Date
A	ISSUED FOR INFORMATION ONLY	DF	CA	HN	06.02.18

HORIZONTAL SCALE
0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

VERTICAL SCALE
0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

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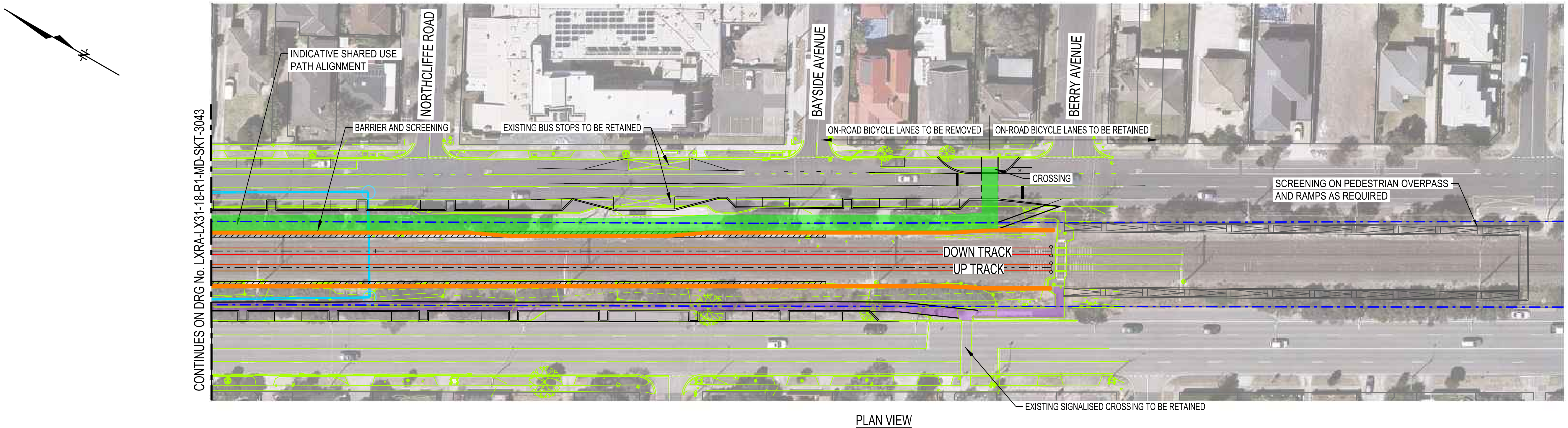
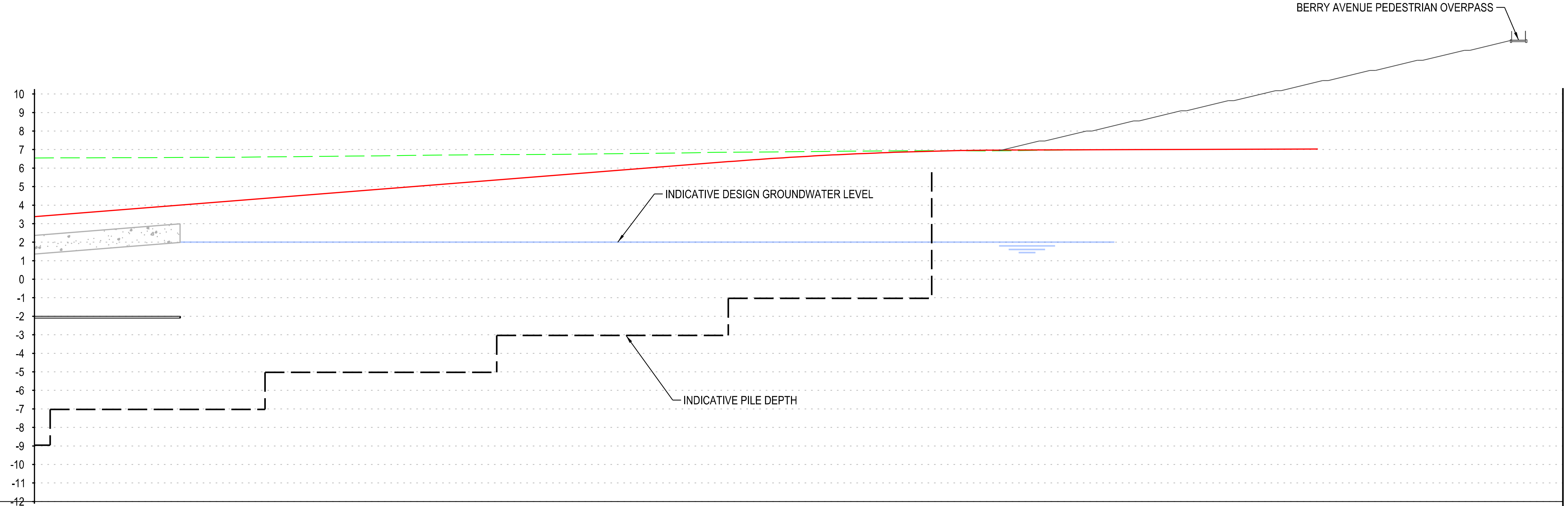
Client LEVEL CROSSING REMOVAL AUTHORITY
Project LX31 - SITE 18 - EDITHVALE ROAD, EDITHVALE
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 3 OF 4
Original Size **A3** Drg No: LXRA-LX31-18-R1-MD-SKT-3043 Rev: A


CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3043
INDICATIVE SHARED USE PATH ALIGNMENT
NORTHCLIFFE ROAD
BARRIER AND SCREENING
EXISTING BUS STOPS TO BE RETAINED
BAYSIDE AVENUE
ON-ROAD BICYCLE LANES TO BE REMOVED
ON-ROAD BICYCLE LANES TO BE RETAINED
BERRY AVENUE
CROSSING
SCREENING ON PEDESTRIAN OVERPASS AND RAMPS AS REQUIRED
DOWN TRACK
UP TRACK
EXISTING SIGNALISED CROSSING TO BE RETAINED

PLAN VIEW
SCALE 1:1000



EXISTING TRACK LEVEL (m)	6.548	6.555	6.561	6.568	6.576	6.603	6.628	6.653	6.681	6.710	6.728	6.736	6.758	6.789	6.820	6.855	6.873	6.898	6.917	6.935	6.937	6.935	6.967	6.991				
PROPOSED TRACK LEVEL (m)	3.382	3.580	3.778	3.976	4.174	4.372	4.570	4.768	4.966	5.164	5.362	5.560	5.758	5.956	6.154	6.352	6.530	6.679	6.798	6.886	6.945	6.975	6.983	6.992	7.000	7.008	7.016	7.024

RAIL LONGITUDINAL SECTION
SCALE 1:1000(H) ; 1:250(V)

PRELIMINARY

No	Revision	Drawn	Designer	Design Check	Date
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HORIZONTAL SCALE
0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

VERTICAL SCALE
0 2.5 5.0 7.5m
SCALE 1:250 AT ORIGINAL SIZE

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LEVEL CROSSING REMOVAL AUTHORITY

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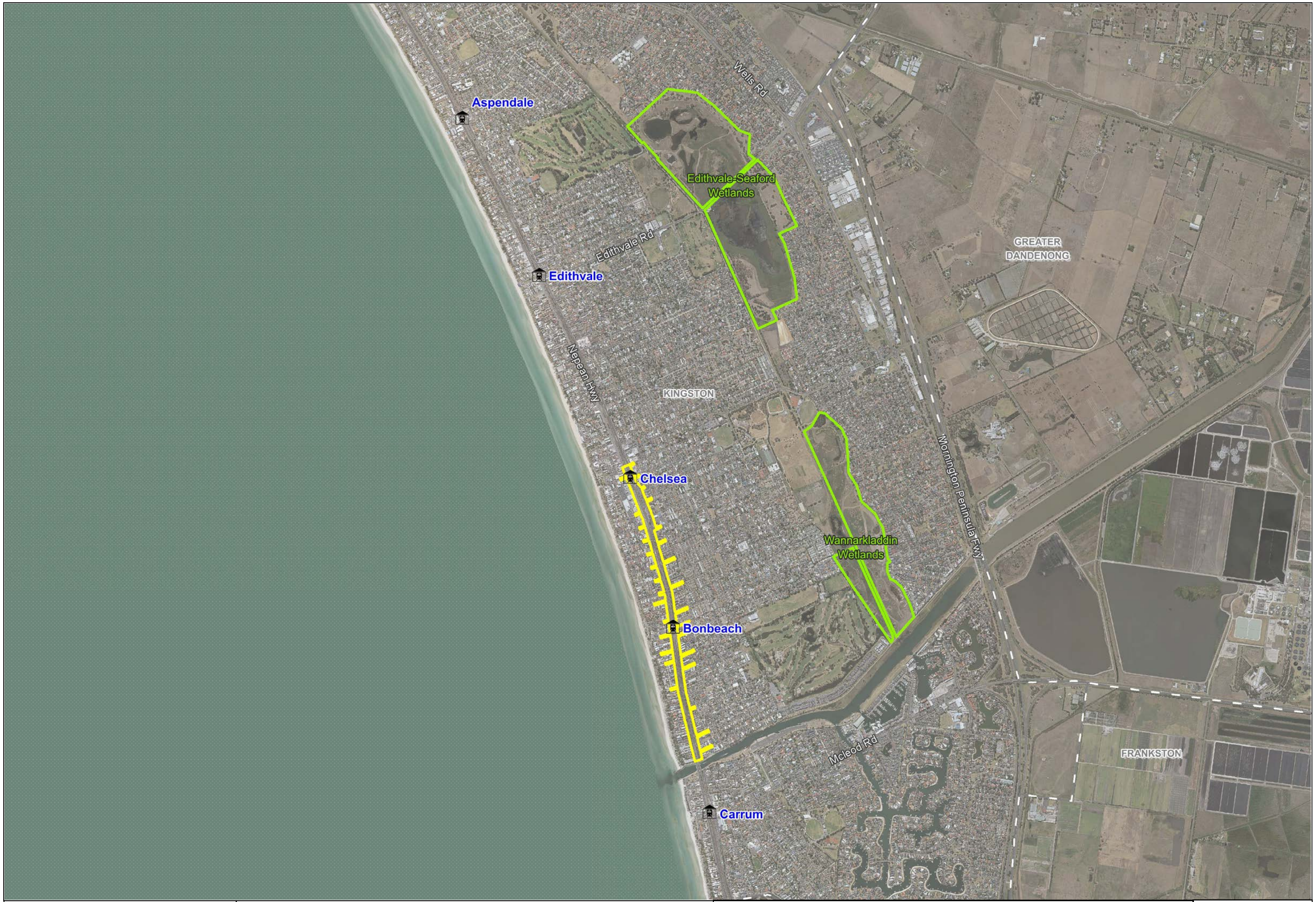
Project LX31 - SITE 18 - EDITHVALE ROAD, EDITHVALE
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 4 OF 4
Original Size A3 Drg No: LXRA-LX31-18-R1-MD-SKT-3044 Rev: A



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0 250 500 750 1,000

Paper Size A3 Scale 1:25,000 metres

Date: 16/02/2018

LEGEND

🟨 Station Street/Bondi Road, Bonbeach - EES Project Area

🟩 Wetlands

🚉 Railway Station

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA - REGION

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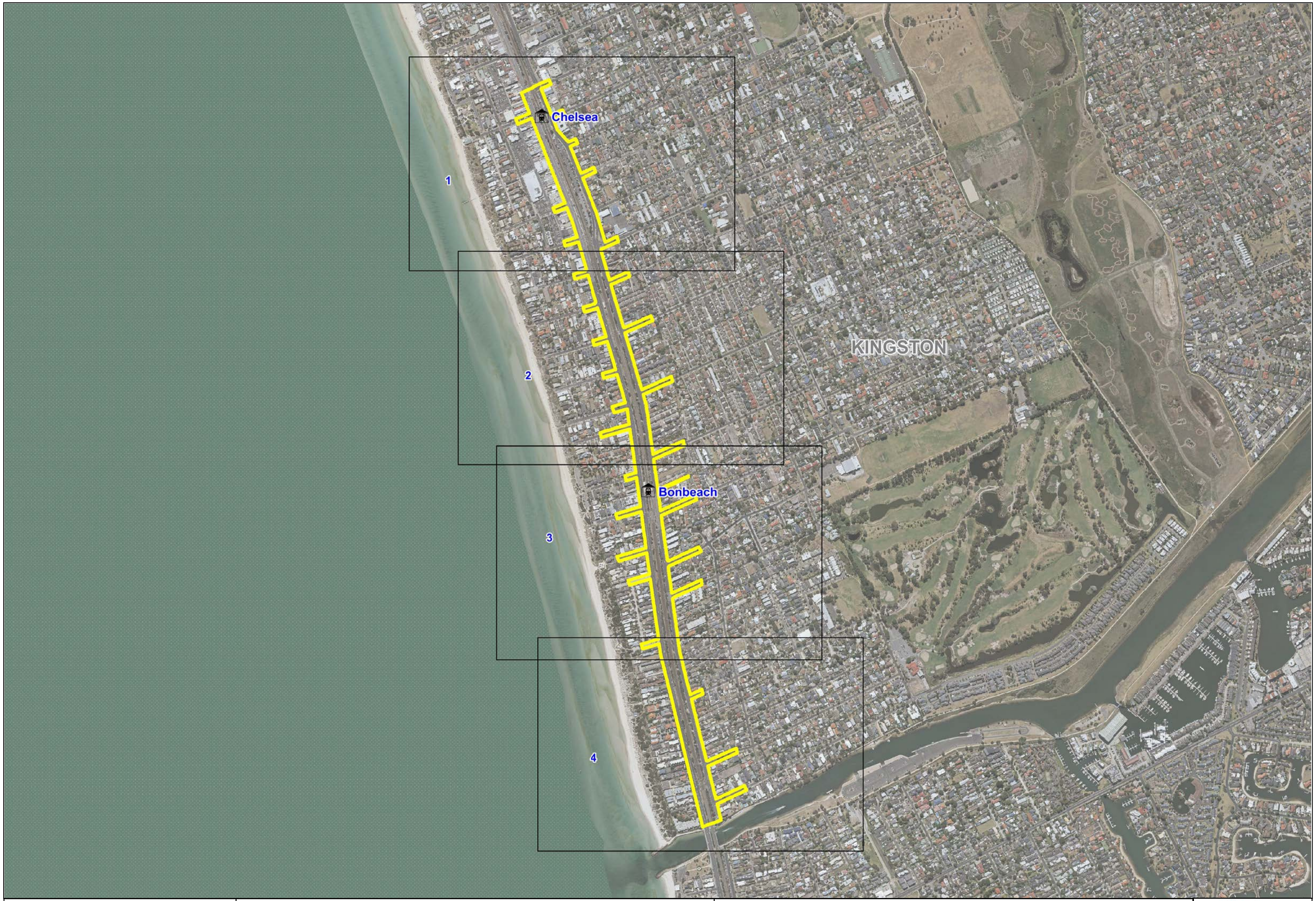

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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Scale 1:2500 @ A3 metres

INDEX

Date: 16/02/2018

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LEGEND

▭	Station Street/Bondi Road, Bonbeach - EES Project Area
🚉	Railway Station

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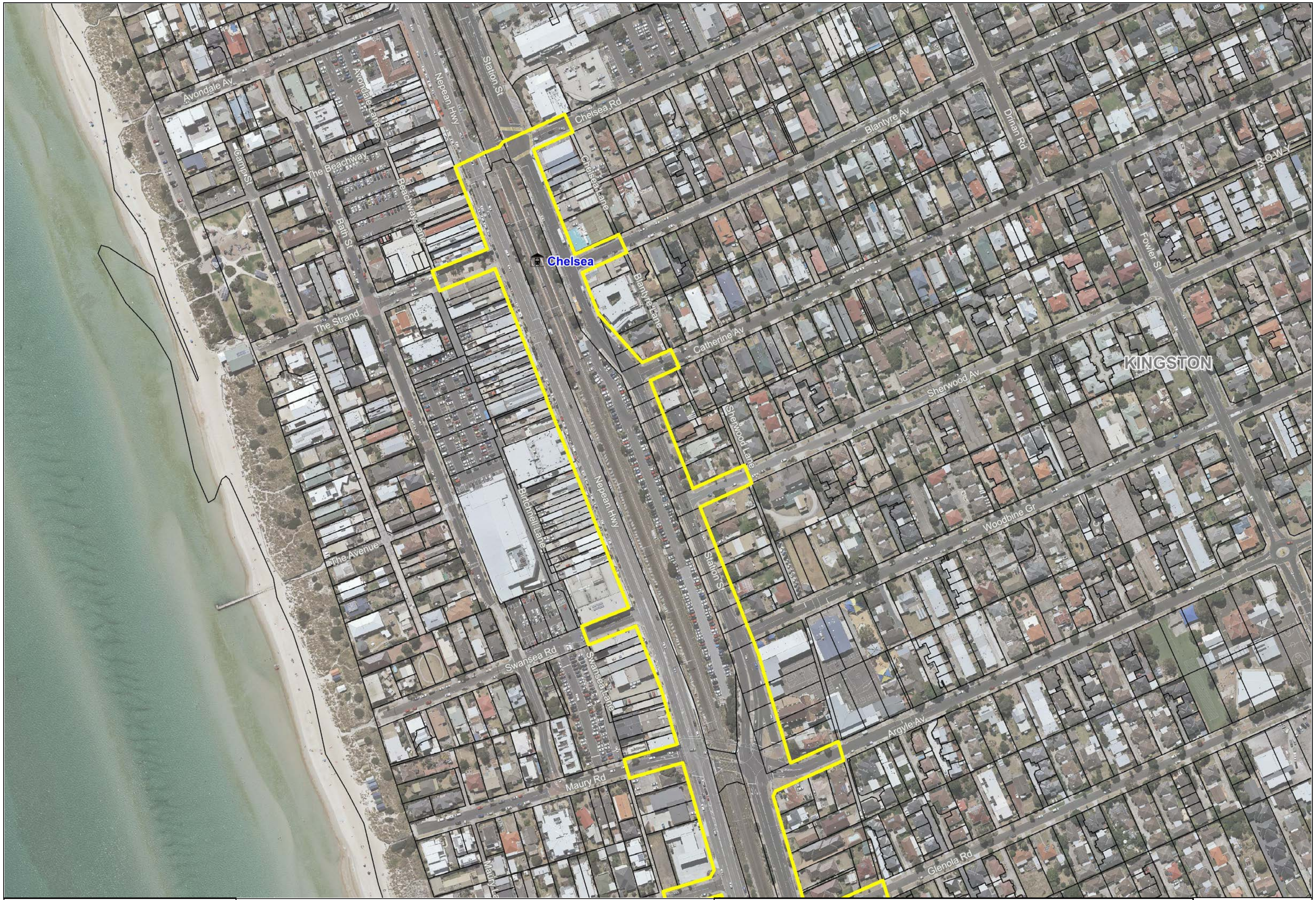

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Scale 1:2500 @ A3 metres

Sheet 1 of 4

Date: 16/02/2018

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LEGEND

🟨	Station Street/Bondi Road, Bonbeach - EES Project Area
🚉	Railway Station
☐	VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH
- EES PROJECT AREA

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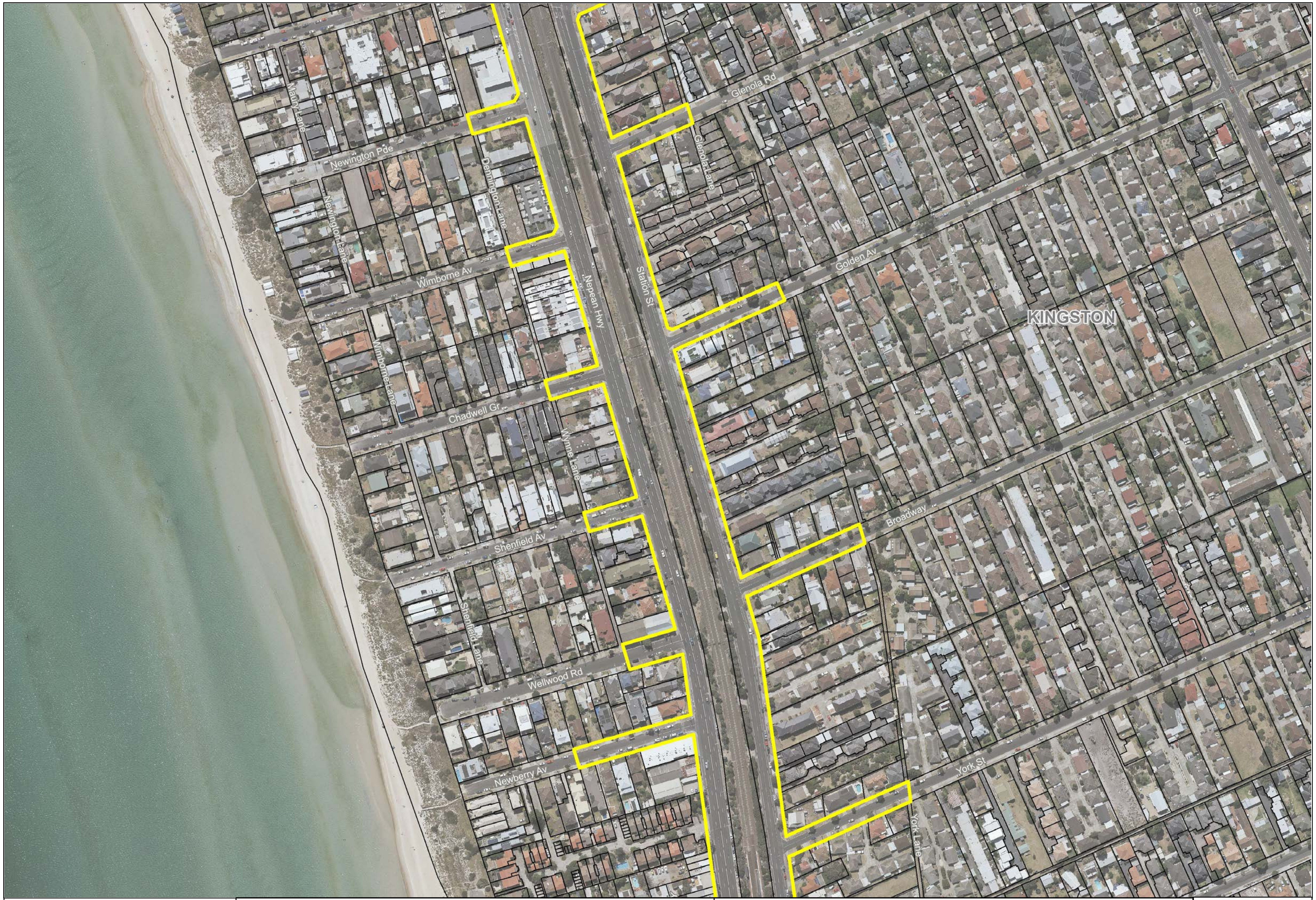

Sheet 2 of 4

Date: 16/02/2018

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LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

Railway Station

▭ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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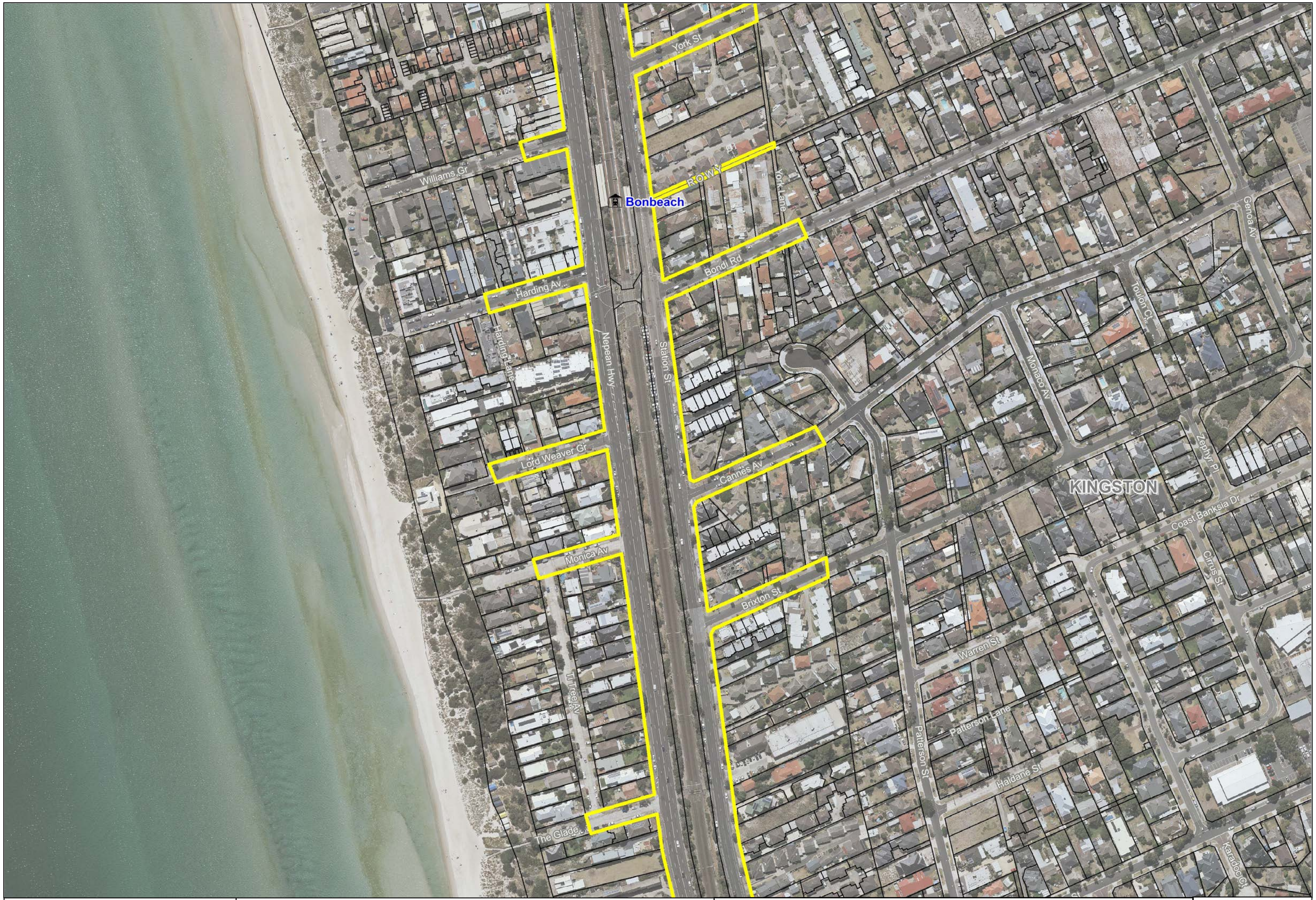

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0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 3 of 4

Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

🚉 Railway Station

▭ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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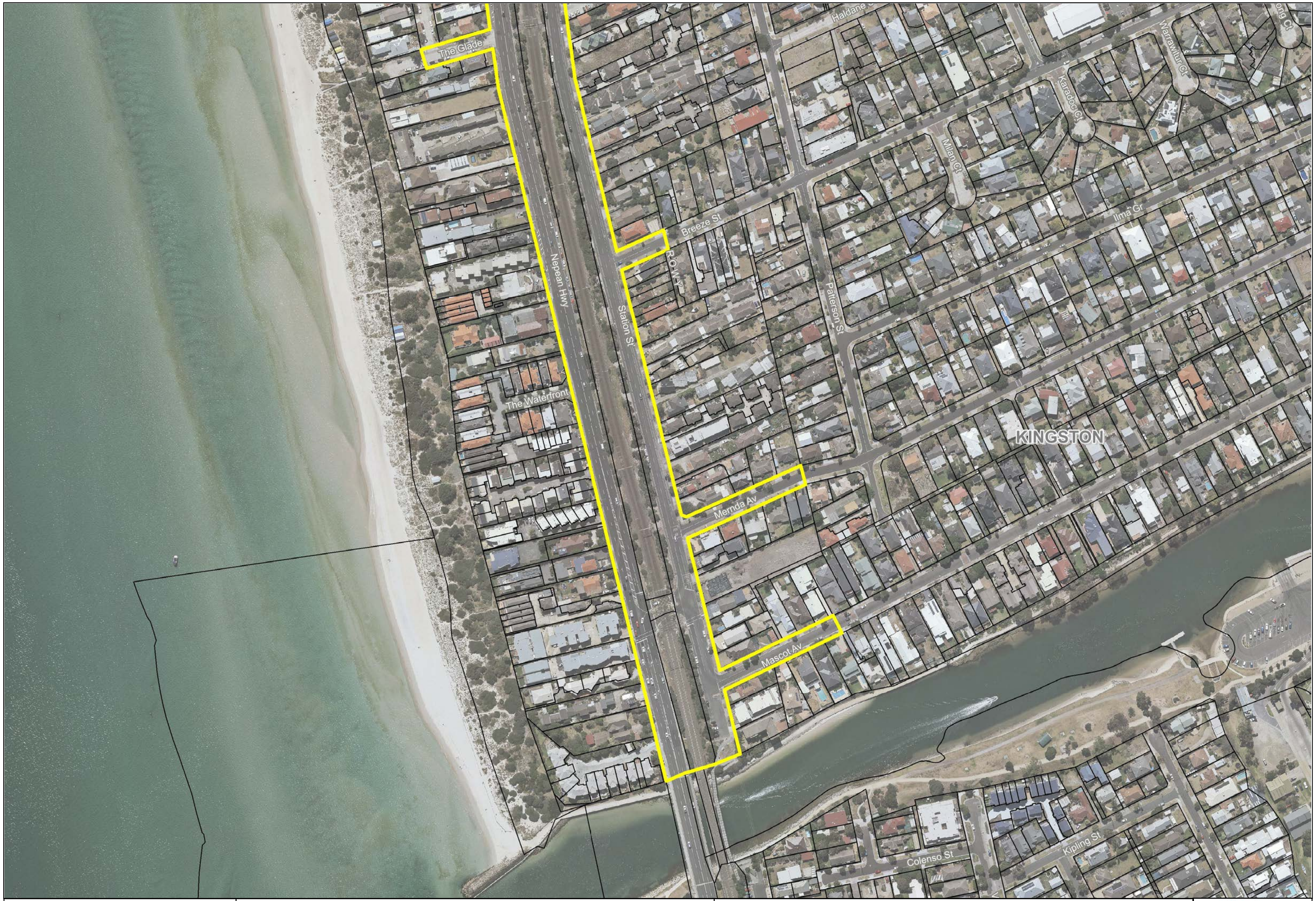

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0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 4 of 4

Date: 16/02/2018

LEGEND

▭	Station Street/Bondi Road, Bonbeach - EES Project Area
🚉	Railway Station
□	VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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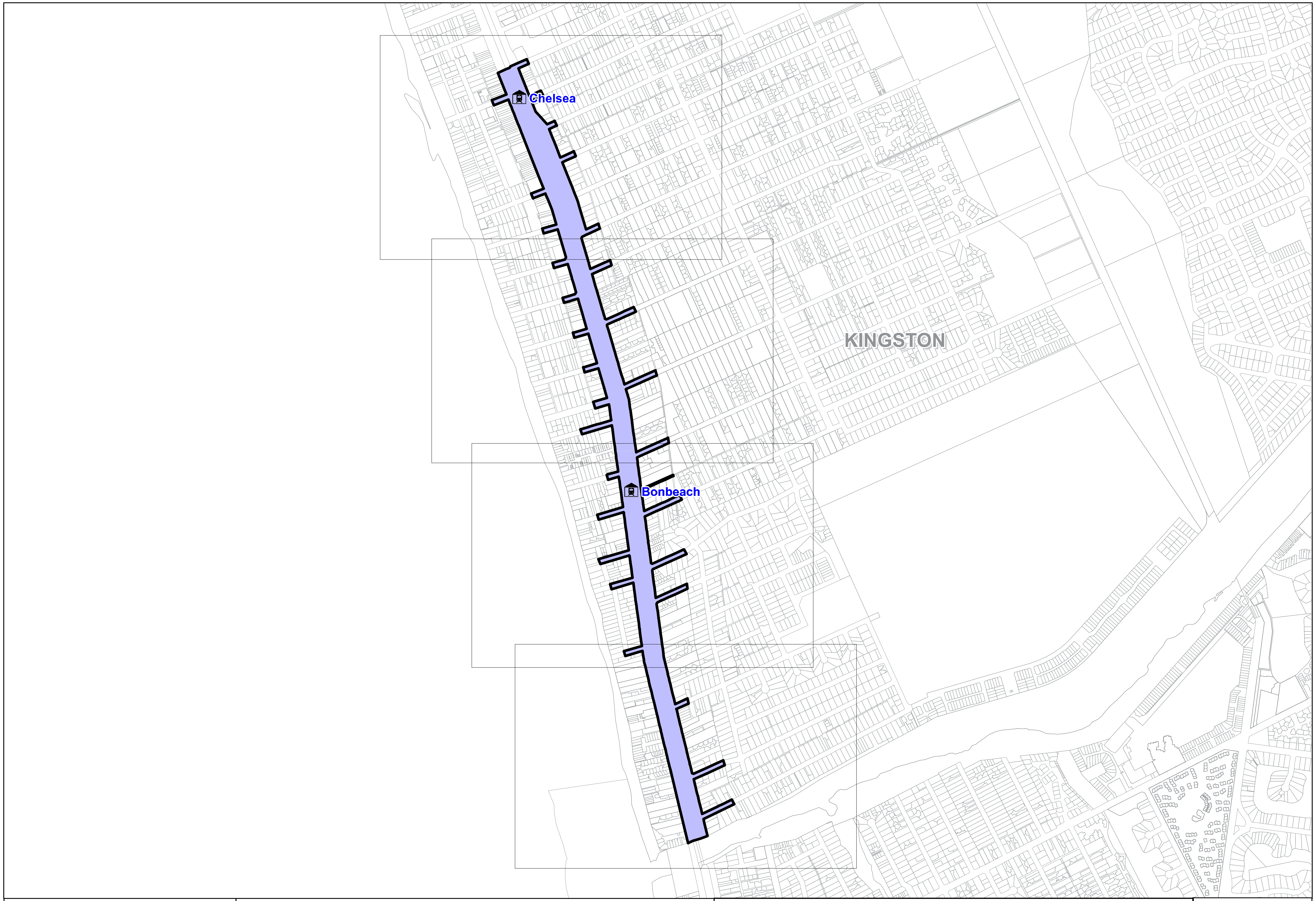

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

INDEX

Date: 16/02/2018

LEGEND

▭	Station Street/Bondi Road, Bonbeach - EES Project Area
	Railway Station
▭	VicMap Cadastre

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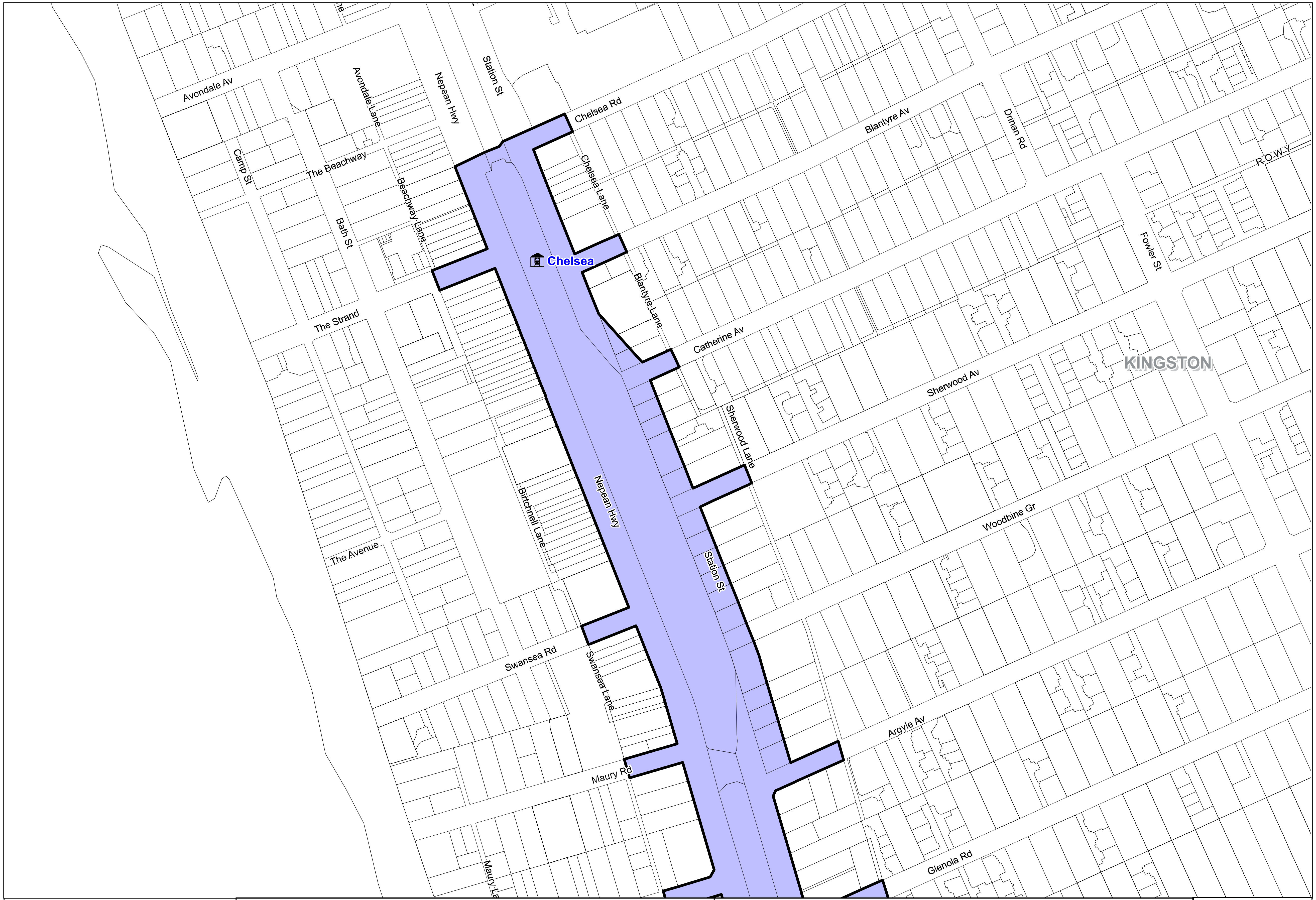

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0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 1 of 4

Date: 16/02/2018

LEGEND

▨ Station Street/Bondi Road, Bonbeach - EES Project Area

🚉 Railway Station

☐ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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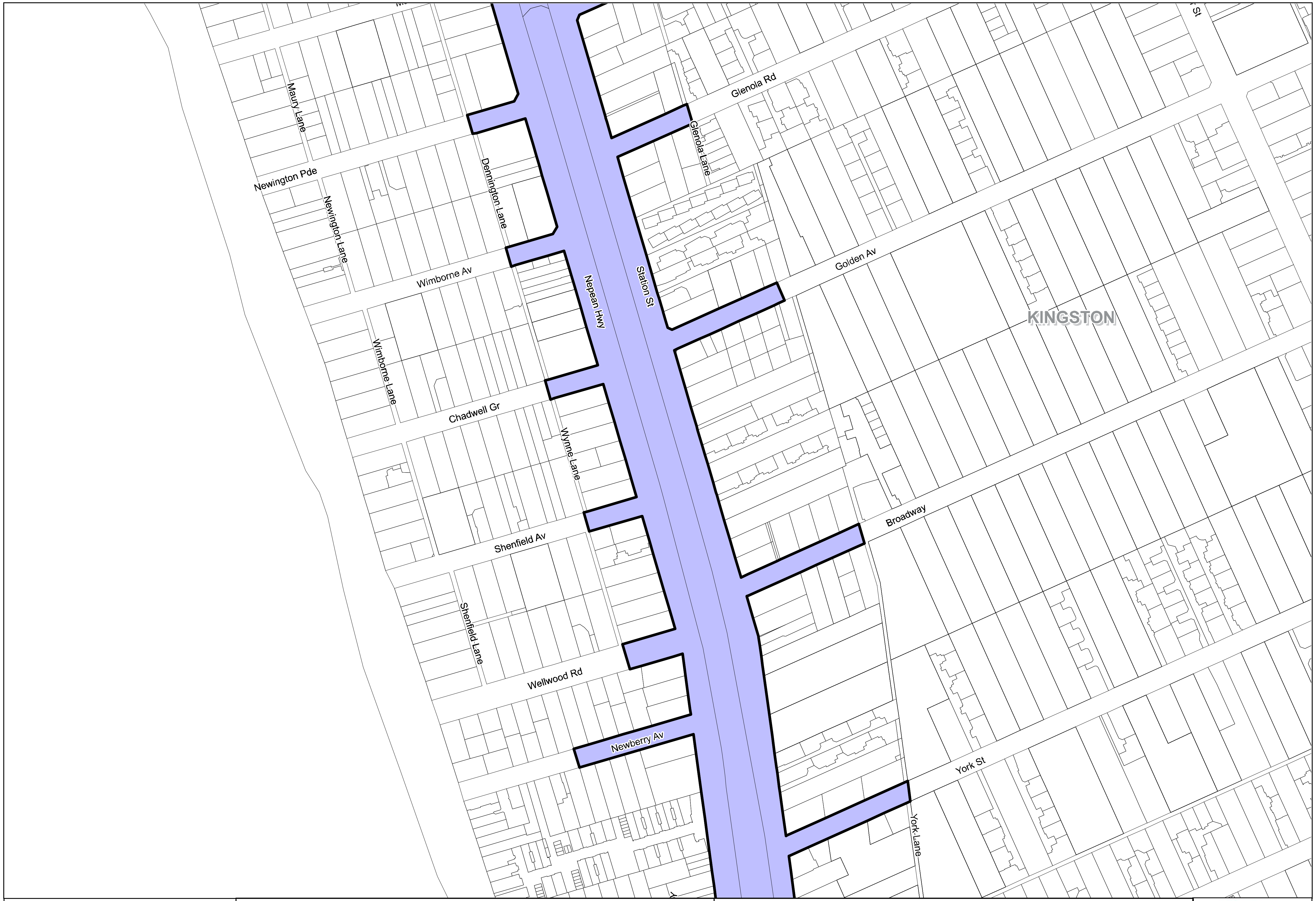

0 25 50 75 100
Scale 1:2500 @ A3 metres

Sheet 2 of 4 | Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

Railway Station

▭ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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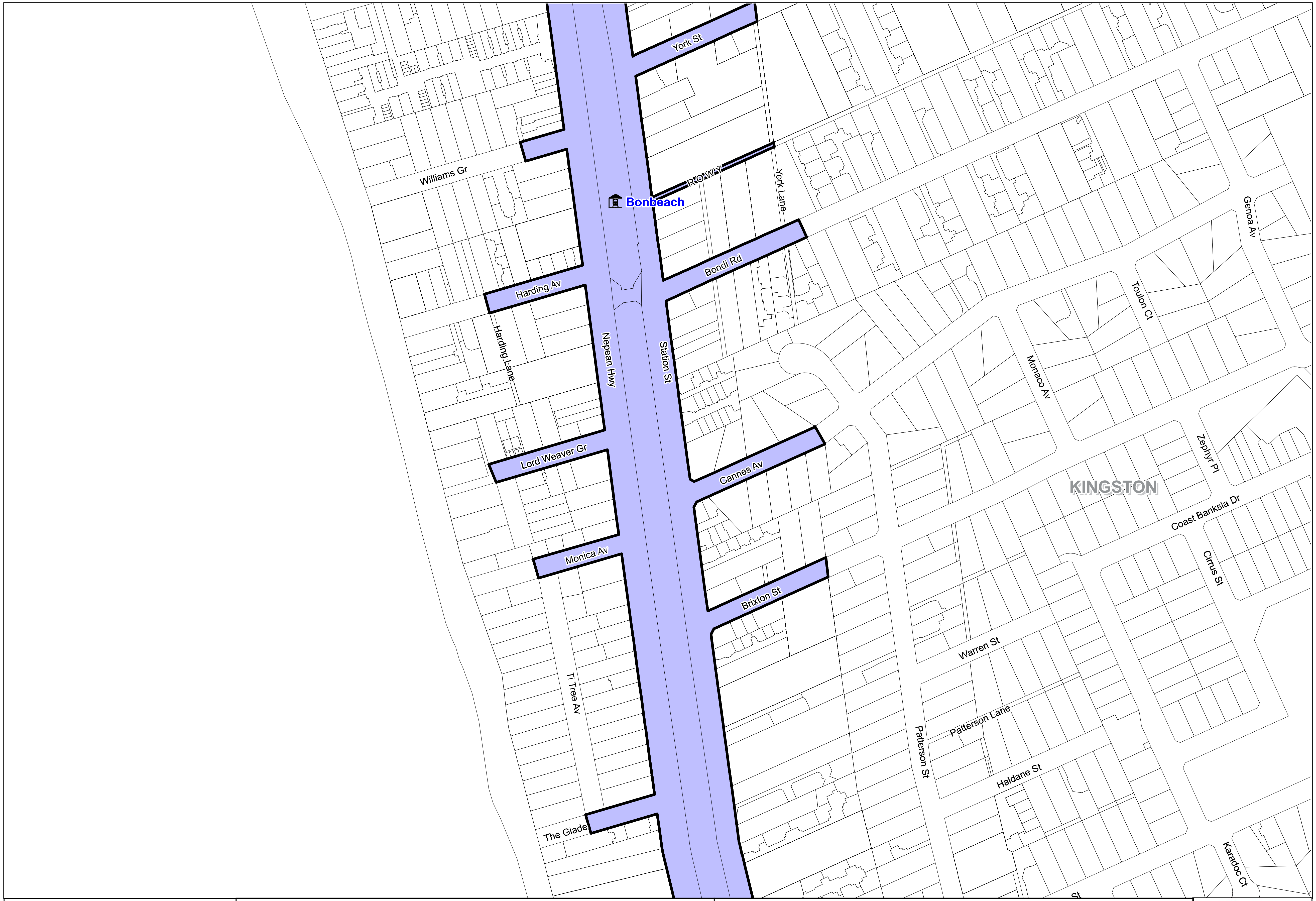

Sheet 3 of 4 | Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

Railway Station

▭ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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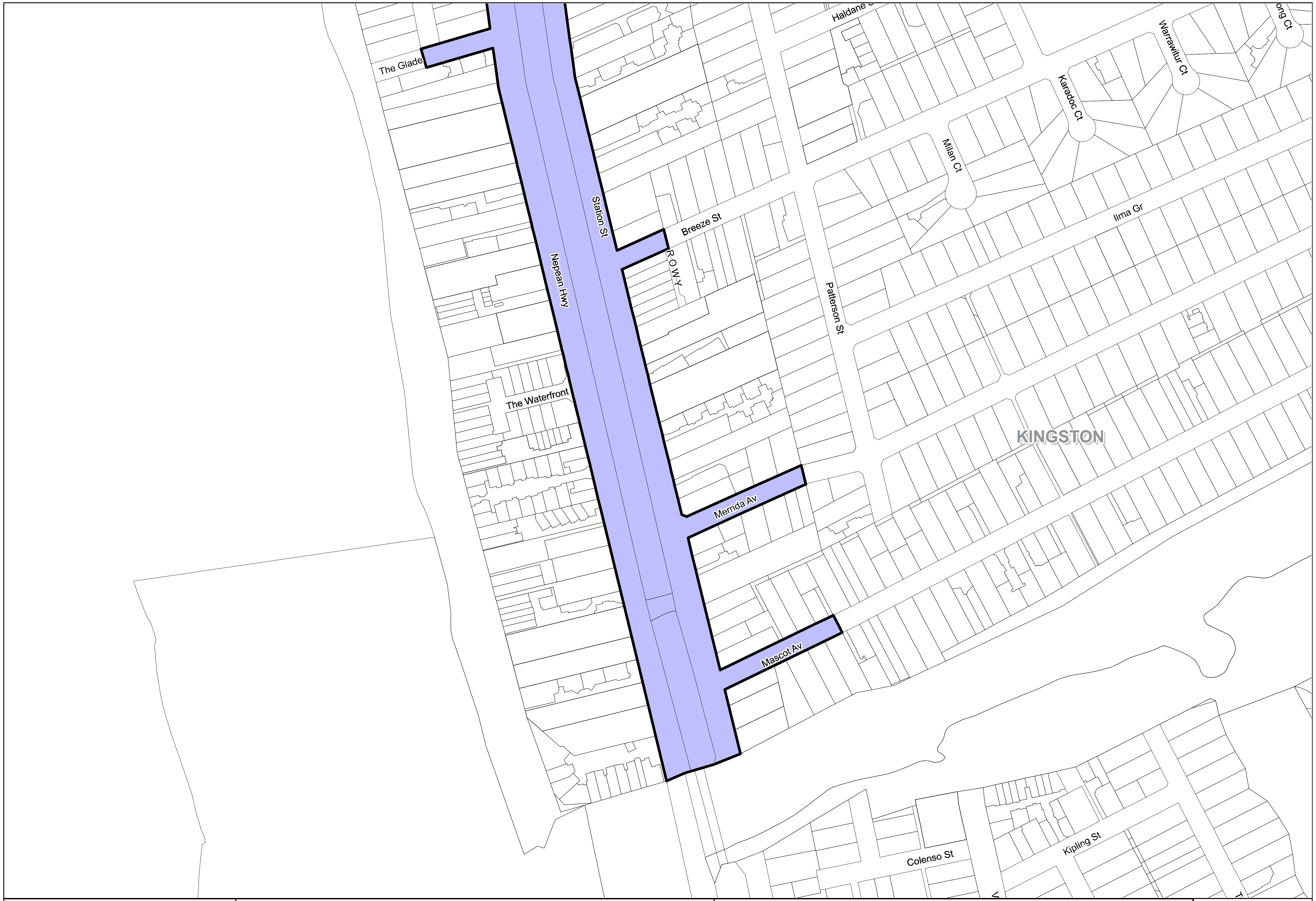

Sheet 4 of 4 | Date: 16/02/2018

X:\Workspaces\Frankston Group\Edithvale Road\PPA\EES\EdithvaleRd_EES_Parcel_v3.wor

LEGEND

▨ Station Street/Bondi Road, Bonbeach - EES Project Area

Railway Station

□ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH - EES PROJECT AREA

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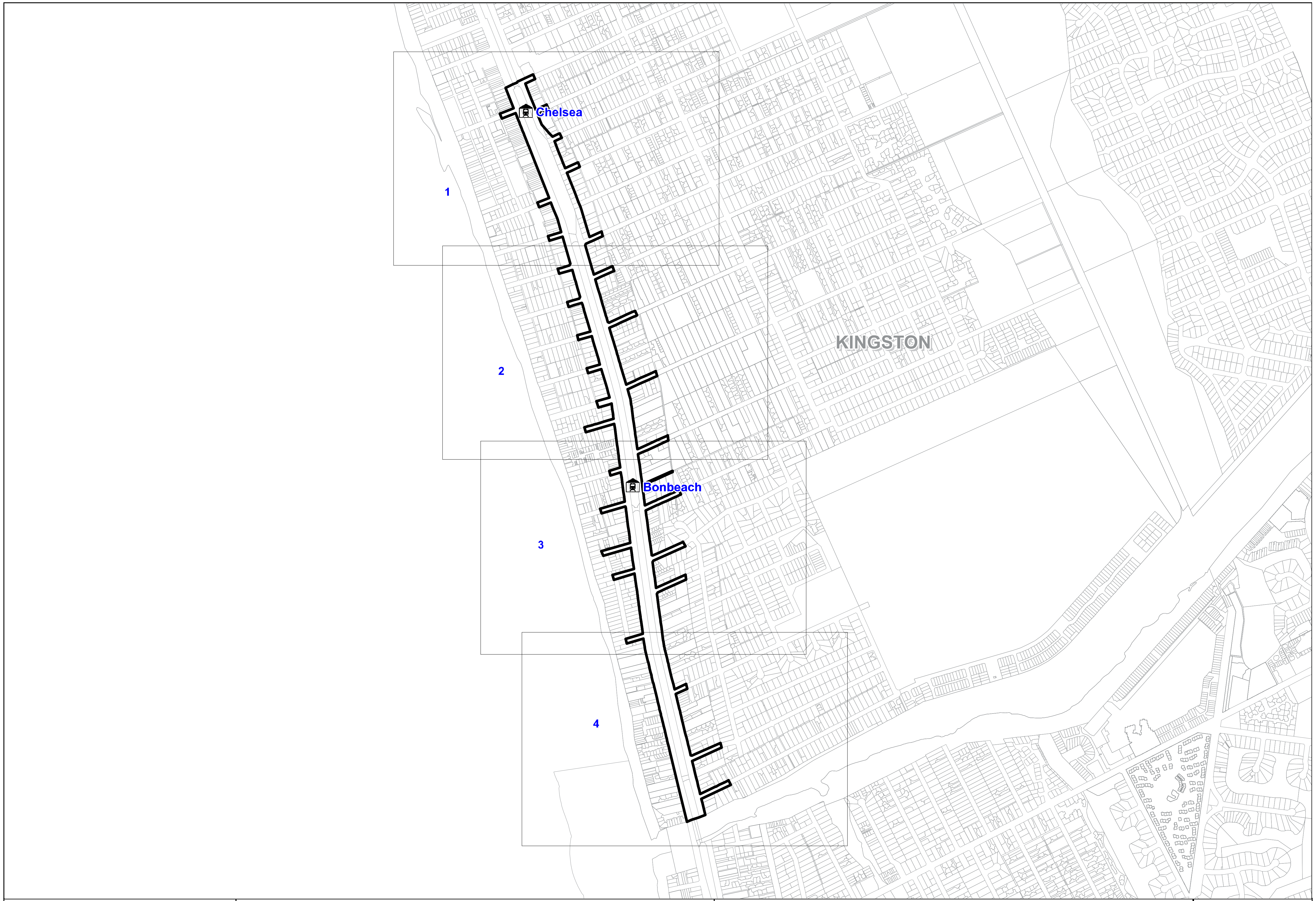

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0 100 200 300 400

Paper size: A3 Scale 1:10,000 metres

INDEX

Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

Railway Station

▭ VicMap Cadastre

STATION STREET / BONDI ROAD, BONBEACH
PLANNING ZONES

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LEVEL CROSSING REMOVAL AUTHORITY

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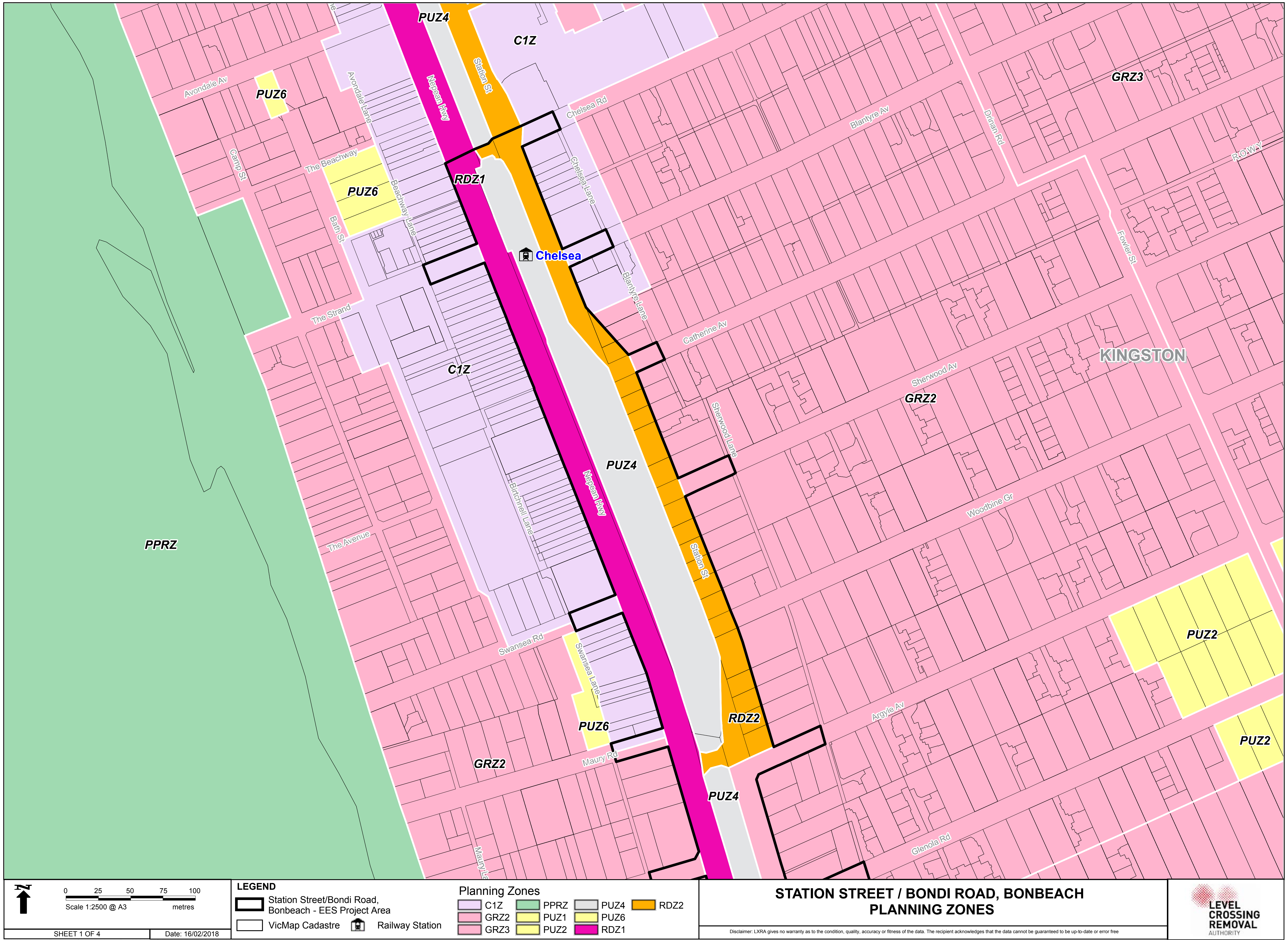

STATION STREET / BONDI ROAD, BONBEACH PLANNING ZONES

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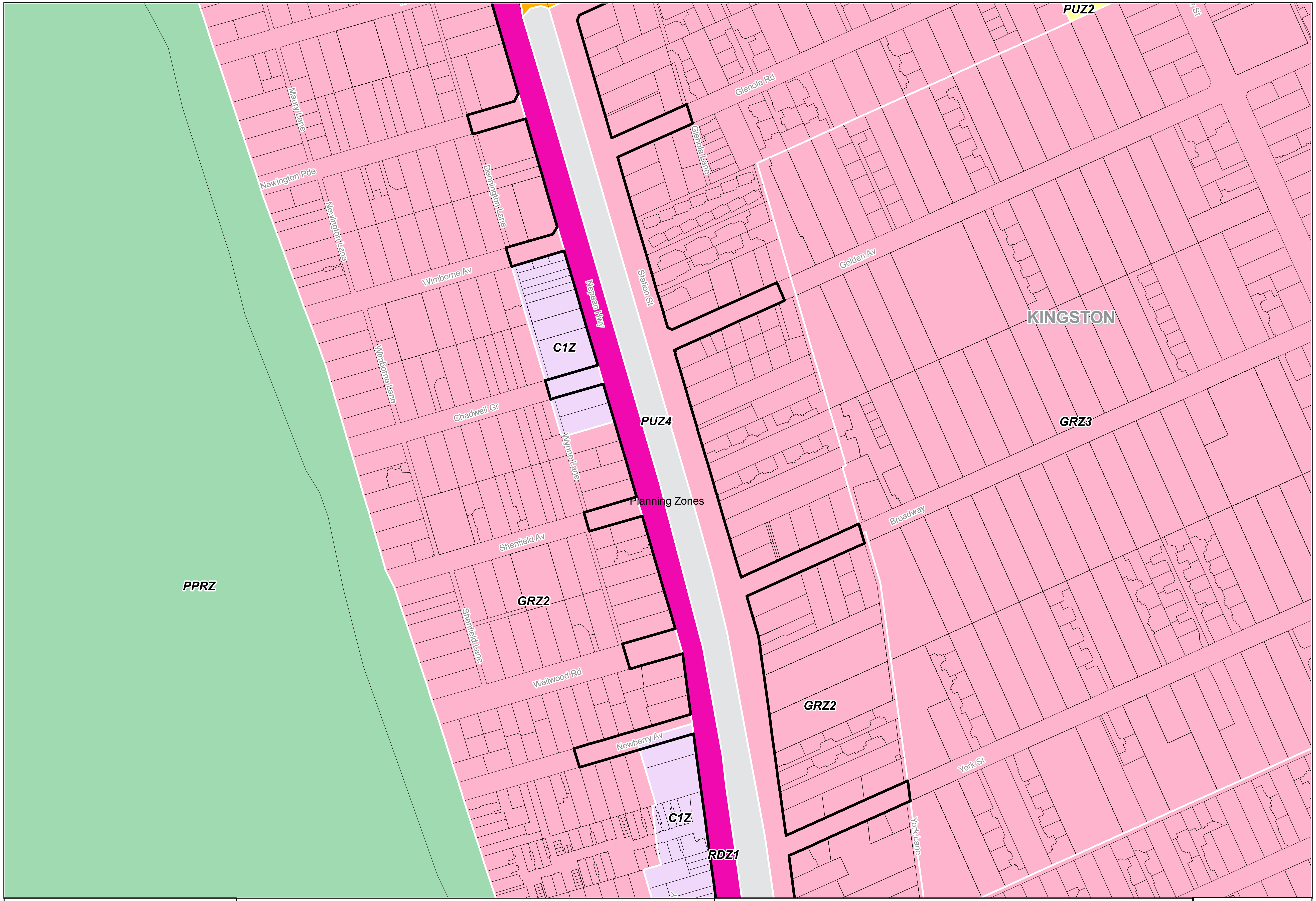

N

0 25 50 75 100
Scale 1:2500 @ A3 metres

SHEET 2 OF 4

Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Zones

C1Z	PPRZ	PUZ4	RDZ2
GRZ2	PUZ1	PUZ6	
GRZ3	PUZ2	RDZ1	

X:\Workspaces\Frankston Group\Edithvale Road\PPA\EES\EdithvaleRd_EES_Parcel_v3.wor

STATION STREET / BONDI ROAD, BONBEACH
PLANNING ZONES

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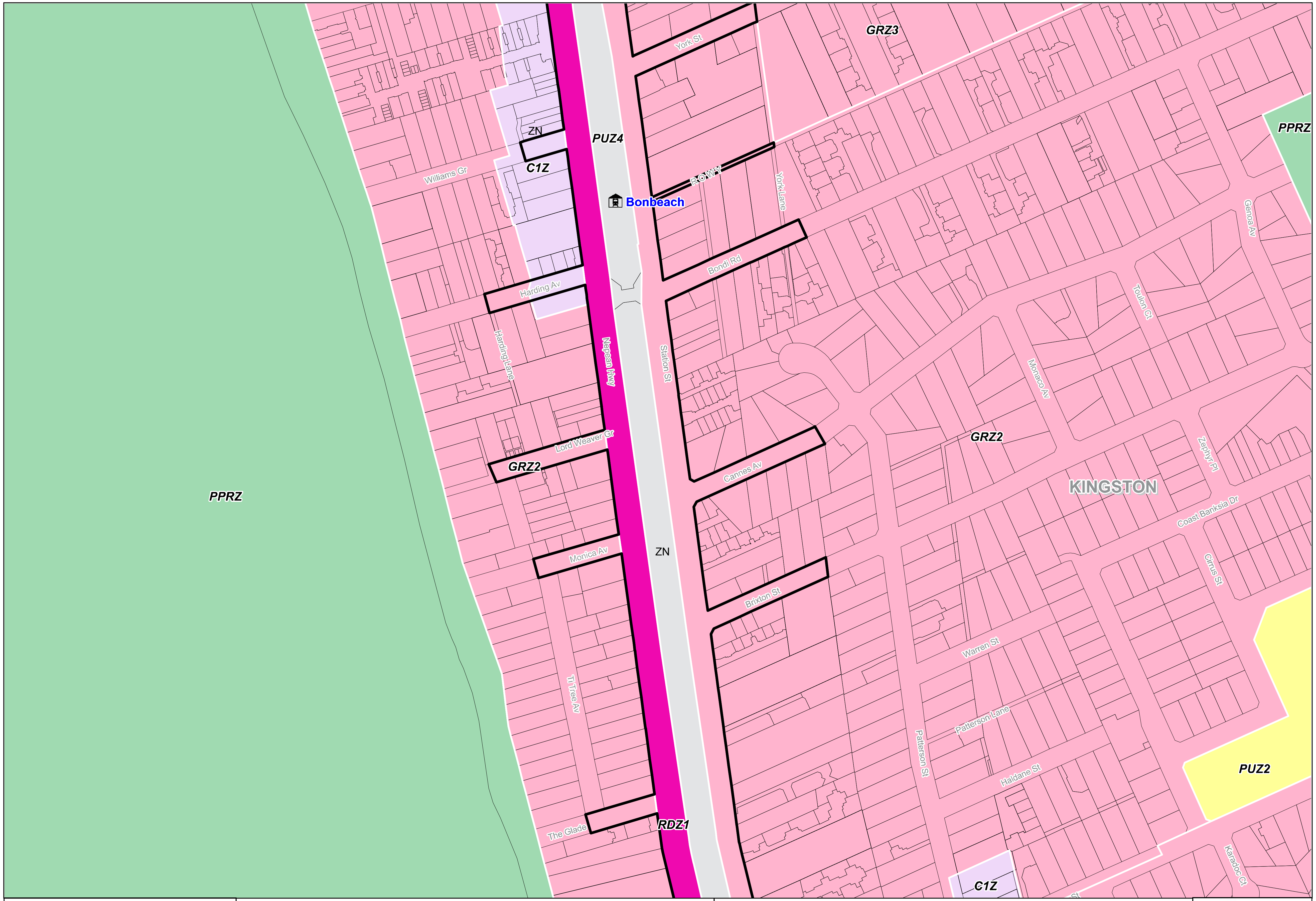

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

SHEET 3 OF 4

Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

▭ VicMap Cadastre

🚉 Railway Station

Planning Zones

🟪 C1Z
🟥 GRZ2
🟥 GRZ3
🟩 PPRZ
🟨 PUZ1
🟨 PUZ2
⬜ PUZ4
🟨 PUZ6
🟥 RDZ1
🟧 RDZ2

STATION STREET / BONDI ROAD, BONBEACH
PLANNING ZONES

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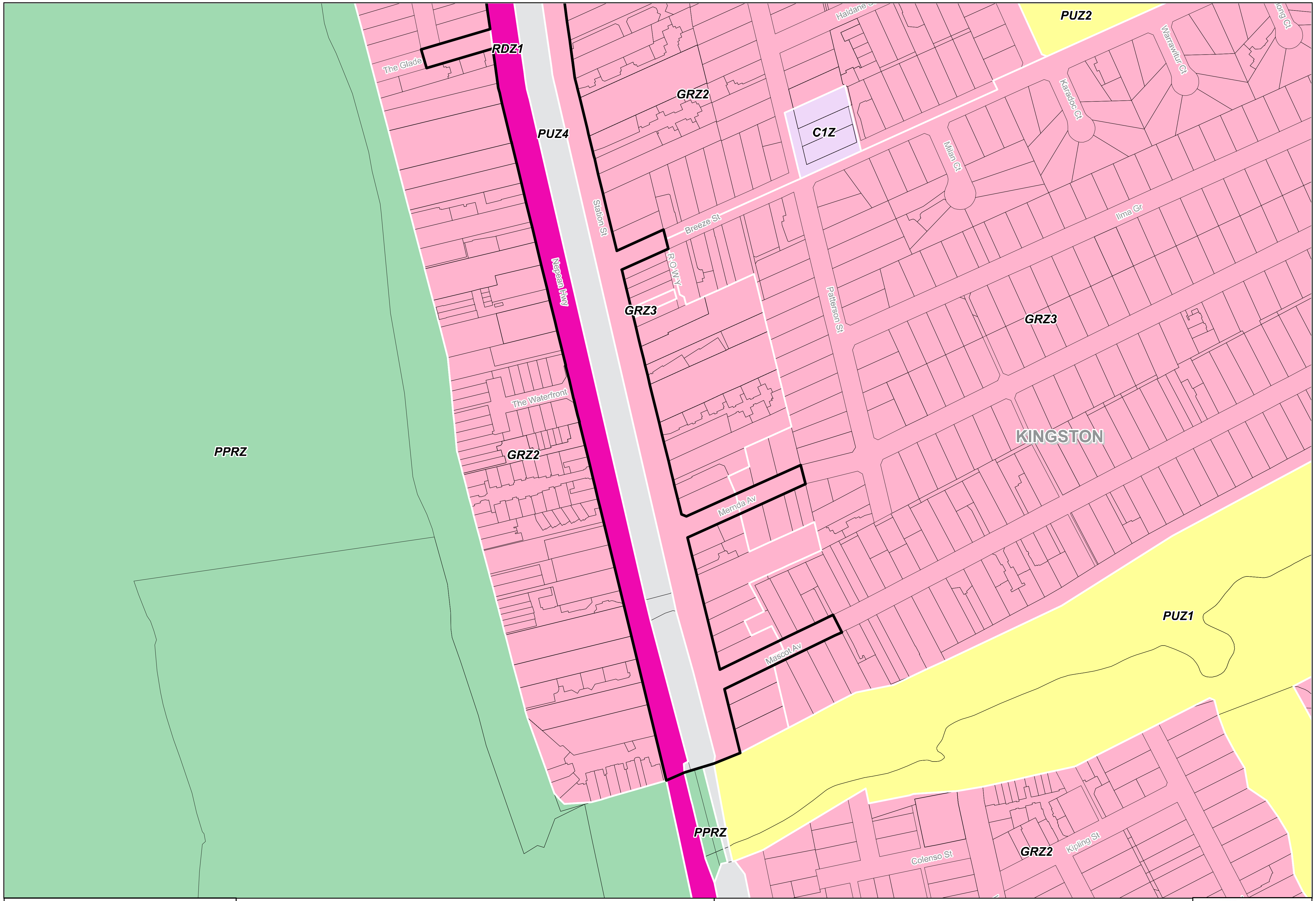

N

0 25 50 75 100

Scale 1:2500 @ A3 metres

SHEET 4 OF 4

Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Zones

C1Z		PPRZ		PUZ4		RDZ2
GRZ2		PUZ1		PUZ6		
GRZ3		PUZ2		RDZ1		

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STATION STREET / BONDI ROAD, BONBEACH
PLANNING ZONES

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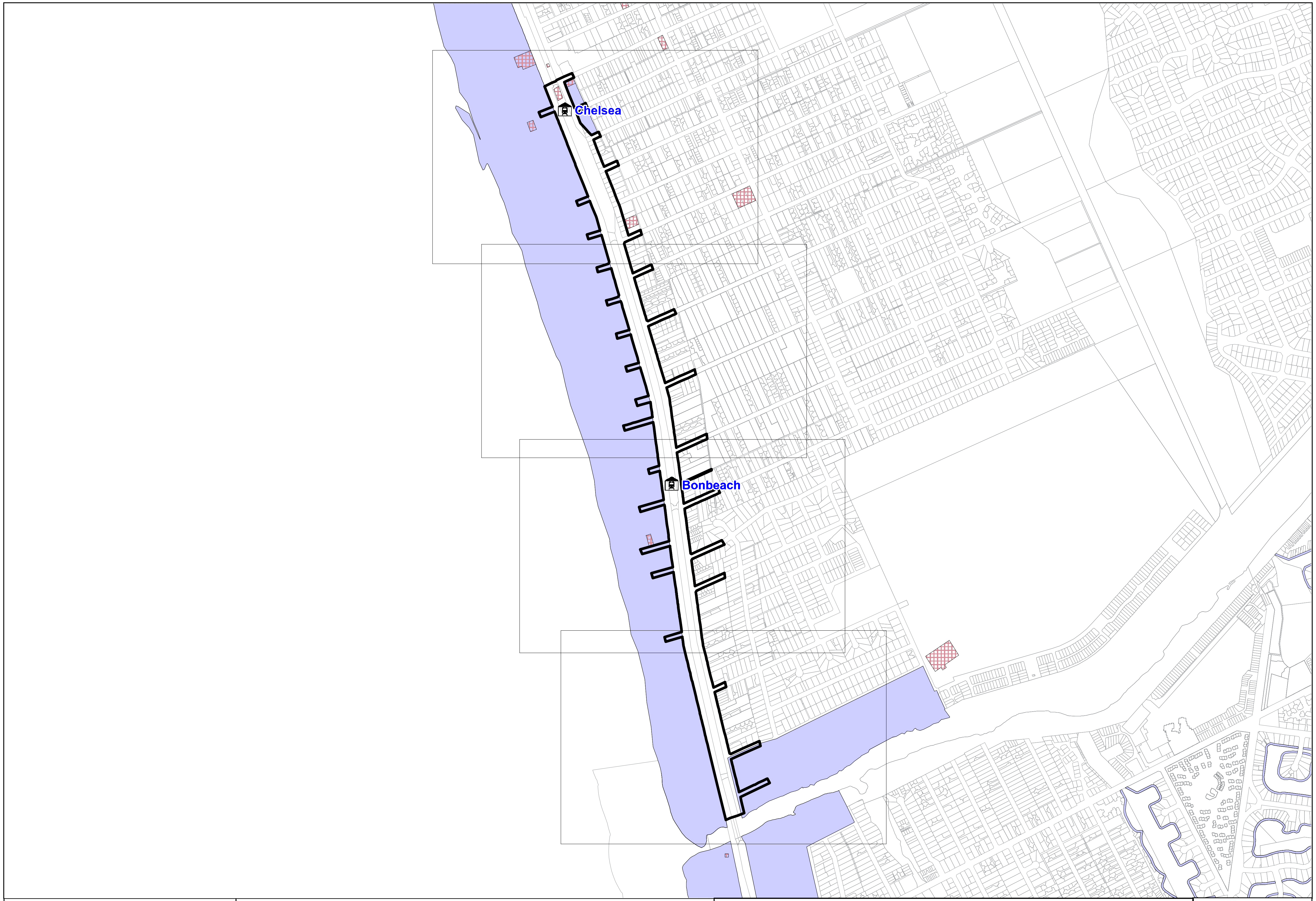

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0 100 200 300 400

Paper size: A3 Scale 1:10,000 metres

INDEX

Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

▭ VicMap Cadastre

Railway Station

STATION STREET / BONDI ROAD, BONBEACH
PLANNING OVERLAYS

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LEVEL CROSSING REMOVAL AUTHORITY

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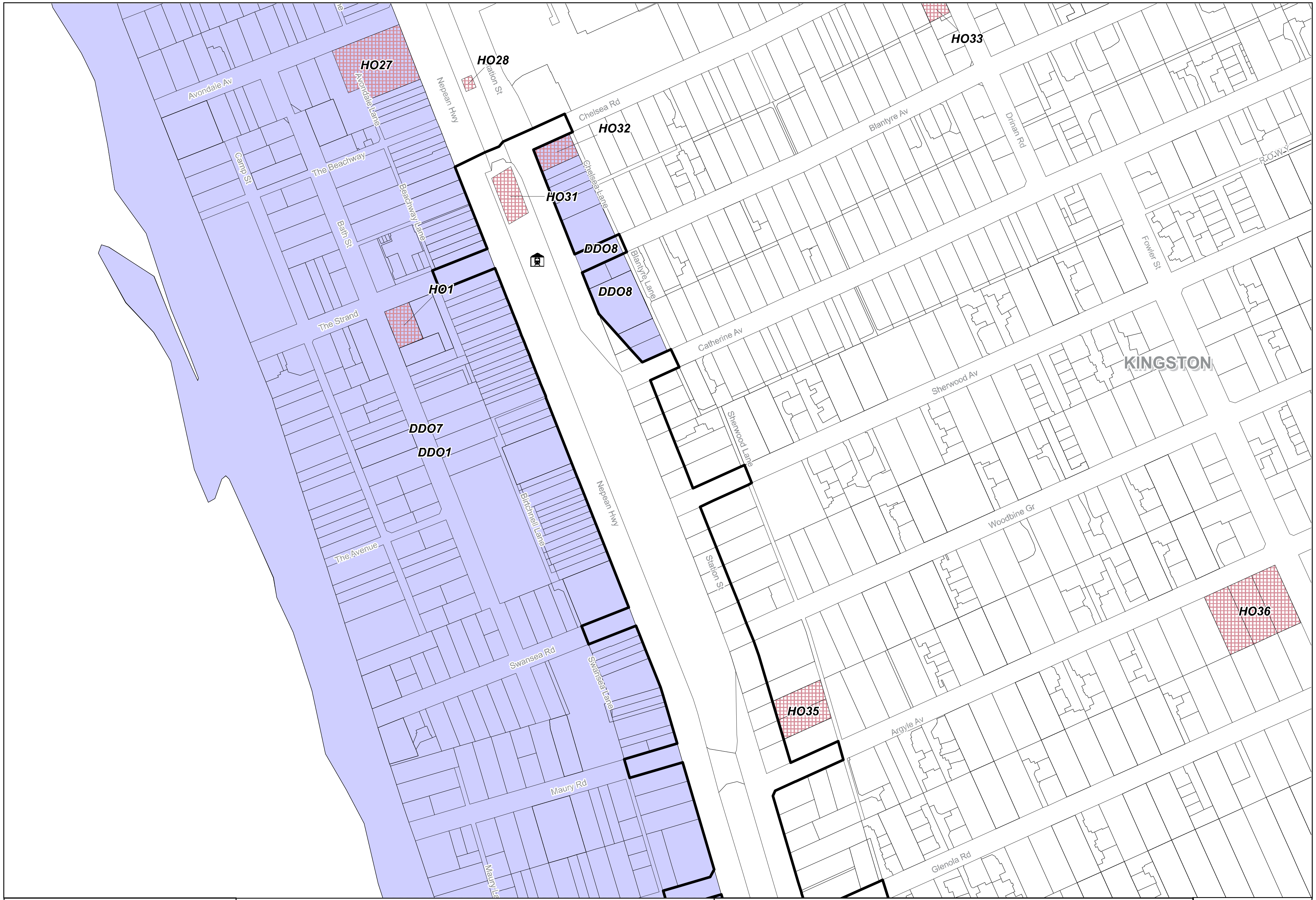

0 25 50 75 100

Scale 1:2500 @ A3 metres

Sheet 1 of 4 Date: 16/02/2018

LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

▭ VicMap Cadastre

🚉 Railway Station

Planning Overlay

▨ HO

🟦 DDO

STATION STREET / BONDI ROAD, BONBEACH
PLANNING OVERLAYS

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LEVEL CROSSING REMOVAL AUTHORITY

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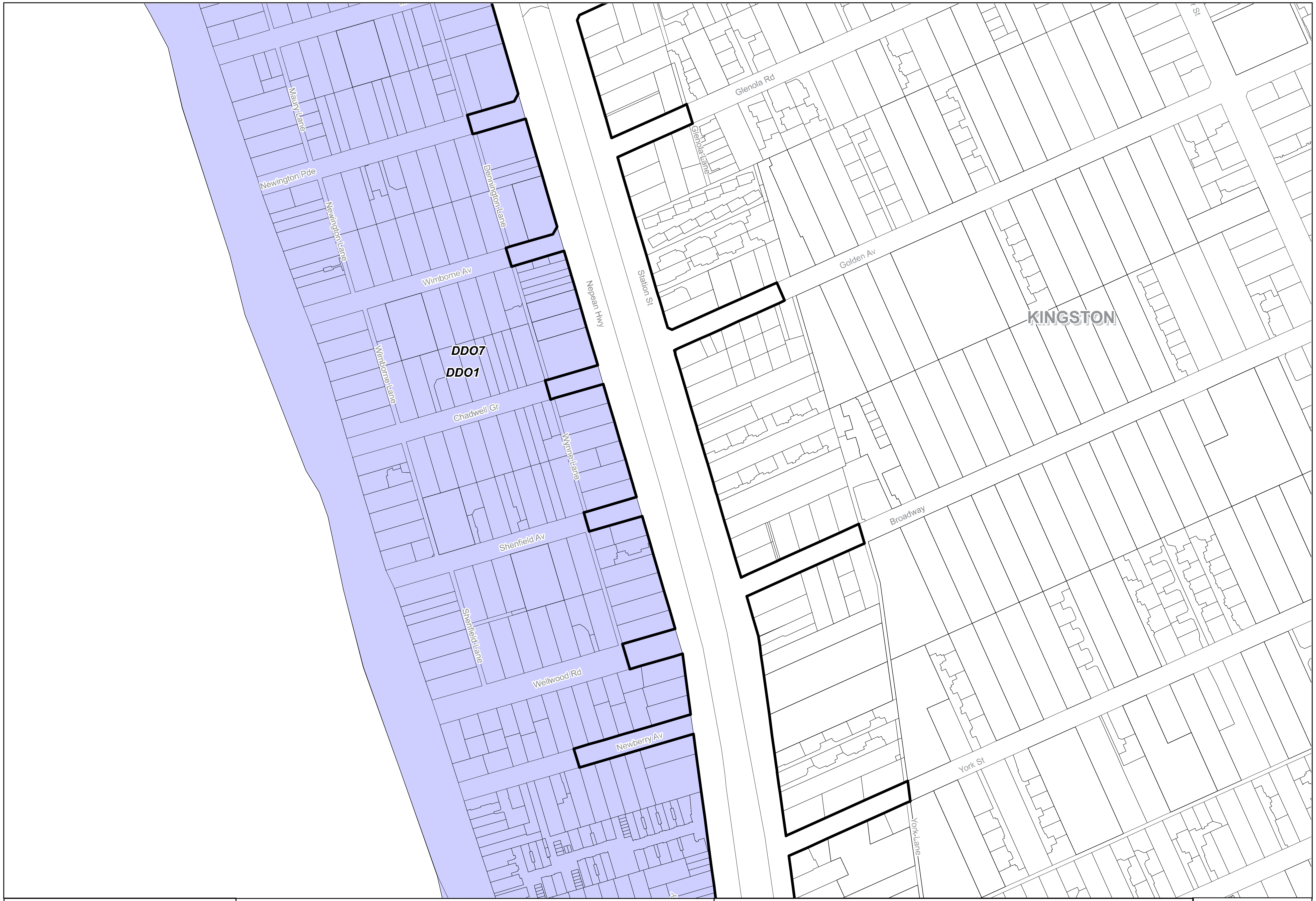

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Sheet 2 of 4 Date: 16/02/2018

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LEGEND

- ▭ Station Street/Bondi Road, Bonbeach - EES Project Area
- ▭ VicMap Cadastre
- Railway Station

Planning Overlay

- ▨ HO
- 🟦 DDO

STATION STREET / BONDI ROAD, BONBEACH
PLANNING OVERLAYS

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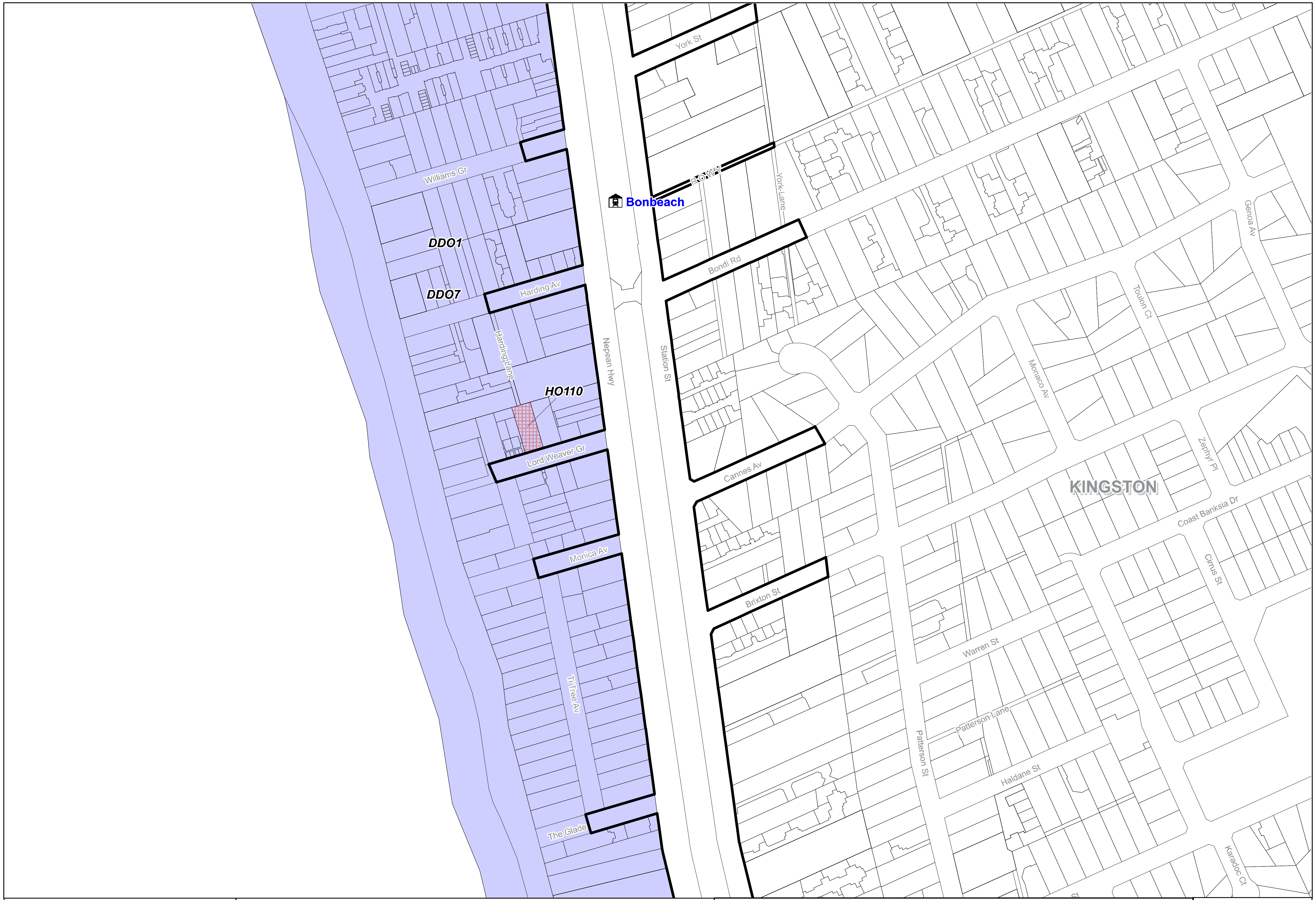

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Sheet 3 of 4
Date: 16/02/2018

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LEGEND

- ▭ Station Street/Bondi Road, Bonbeach - EES Project Area
- ▭ VicMap Cadastre
- 🚉 Railway Station

Planning Overlay

- ▨ HO
- ■ DDO

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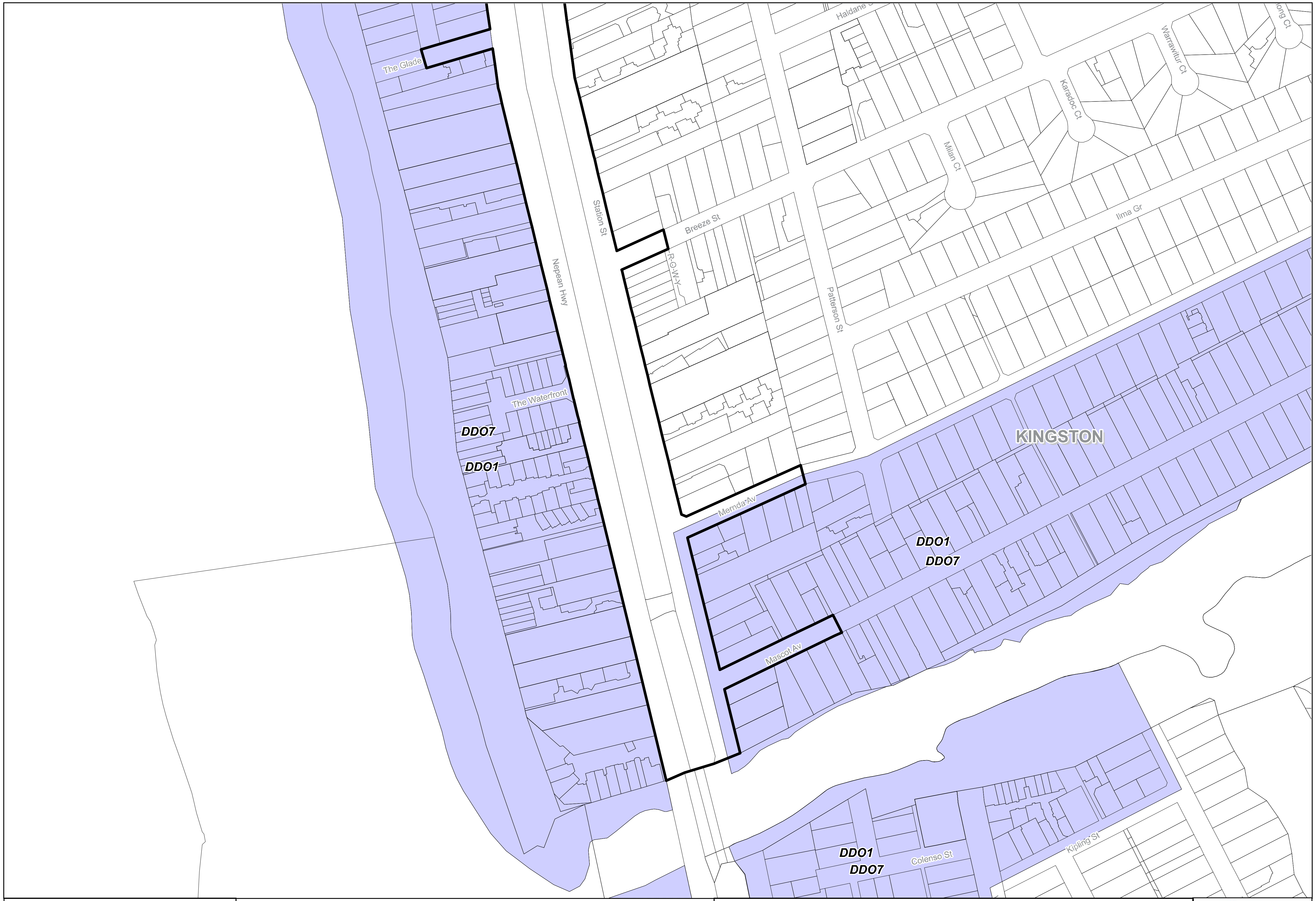

Sheet 4 of 4

Date: 16/02/2018

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LEGEND

▭ Station Street/Bondi Road, Bonbeach - EES Project Area

▭ VicMap Cadastre

Railway Station

Planning Overlay

▨ HO

▨ DDO

STATION STREET / BONDI ROAD, BONBEACH
PLANNING OVERLAYS

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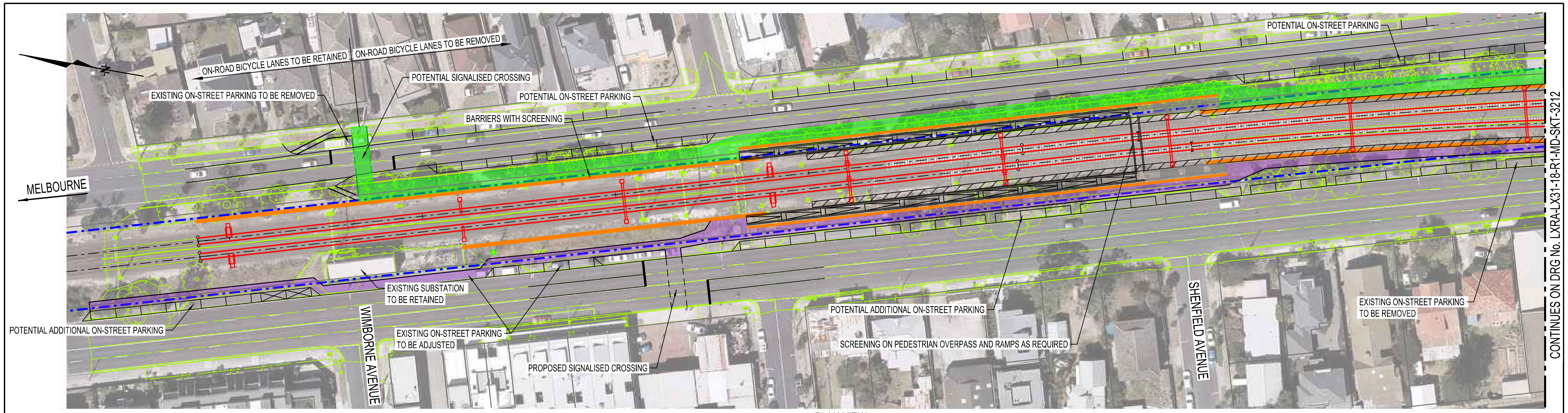
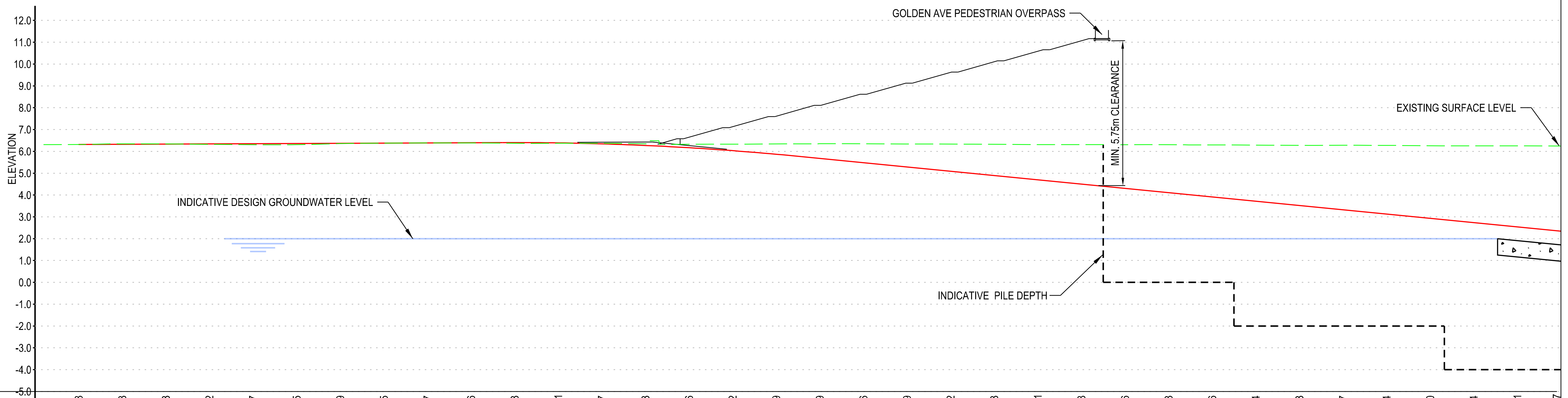

MELBOURNE
ON-ROAD BICYCLE LANES TO BE RETAINED
ON-ROAD BICYCLE LANES TO BE REMOVED
EXISTING ON-STREET PARKING TO BE REMOVED
POTENTIAL SIGNALISED CROSSING
POTENTIAL ON-STREET PARKING
BARRIERS WITH SCREENING
POTENTIAL ON-STREET PARKING
EXISTING SUBSTATION TO BE RETAINED
EXISTING ON-STREET PARKING TO BE ADJUSTED
PROPOSED SIGNALISED CROSSING
POTENTIAL ADDITIONAL ON-STREET PARKING
POTENTIAL ADDITIONAL ON-STREET PARKING
SCREENING ON PEDESTRIAN OVERPASS AND RAMPS AS REQUIRED
EXISTING ON-STREET PARKING TO BE REMOVED
WIMBORNE AVENUE
SHENFIELD AVENUE
CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3212

PLAN VIEW
SCALE 1:1000



EXISTING TRACK LEVEL (m)	6.318	6.343	6.343	6.322	6.307	6.305	6.359	6.375	6.387	6.386	6.373	6.371	6.367	6.343	6.326	6.332	6.339	6.349	6.346	6.339	6.332	6.323	6.311	6.308	6.306	6.303	6.296	6.284	6.273	6.277	6.274	6.260	6.254	6.251	6.247
PROPOSED TRACK LEVEL (m)	6.318	6.326	6.335	6.343	6.352	6.361	6.369	6.378	6.387	6.395	6.403	6.388	6.344	6.270	6.166	6.032	5.868	5.677	5.481	5.285	5.089	4.893	4.697	4.501	4.305	4.109	3.913	3.717	3.521	3.325	3.129	2.933	2.737	2.541	2.345

LONGITUDINAL SECTION
SCALES HORIZ. 1:1000, VERT :100

PRELIMINARY

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SCALE 1:100 AT ORIGINAL SIZE

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SCALE 1:1000 AT ORIGINAL SIZE

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Design Check H.NGUYEN
Approved (Project Manager)
Date
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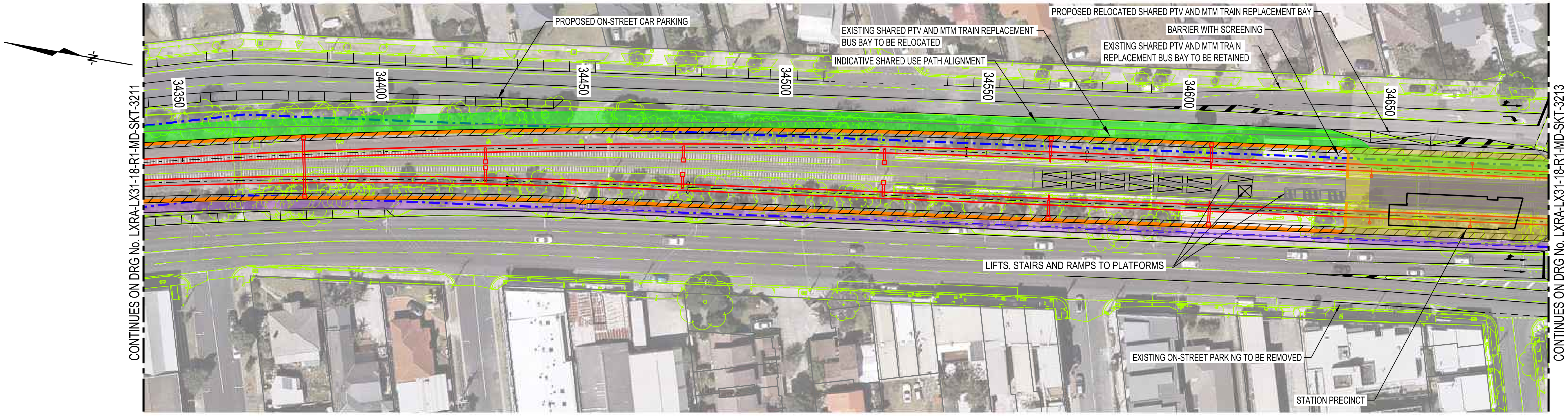
Client LEVEL CROSSING REMOVAL AUTHORITY
Project LX31 - SITE 46 - STATION STREET, BONBEACH
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 1 OF 4
Original Size A3 Drg No: LXRA-LX31-46-R1-MD-SKT-3211 Rev: A

CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3211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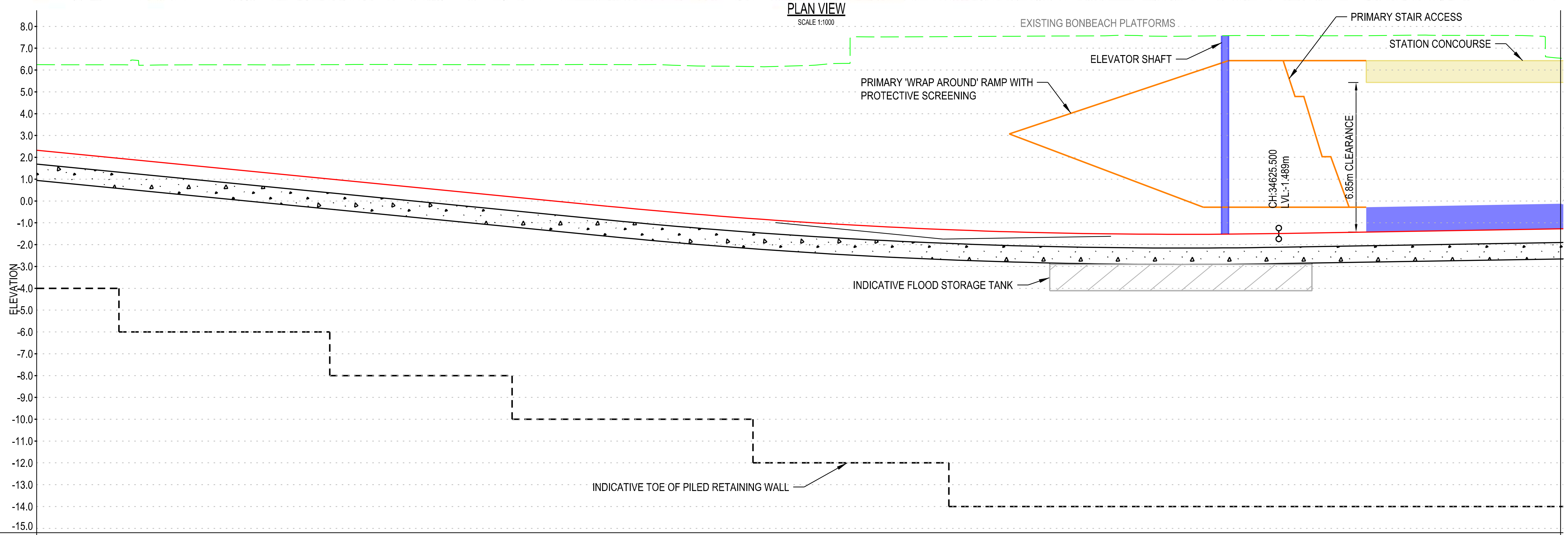
EXISTING SHARED PTV AND MTM TRAIN REPLACEMENT BUS BAY TO BE RELOCATED
INDICATIVE SHARED USE PATH ALIGNMENT
PROPOSED RELOCATED SHARED PTV AND MTM TRAIN REPLACEMENT BAY
BARRIER WITH SCREENING
EXISTING SHARED PTV AND MTM TRAIN REPLACEMENT BUS BAY TO BE RETAINED
34350
34400
34450
34500
34550
34600
34650
LIFTS, STAIRS AND RAMPS TO PLATFORMS
EXISTING ON-STREET PARKING TO BE REMOVED
STATION PRECINCT

CONTINUES ON DRG No. LXRA-LX31-18-R1-MD-SKT-3213

PLAN VIEW
SCALE 1:1000



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PROPOSED TRACK LEVEL (m)	2.149	1.953	1.757	1.561	1.365	1.169	0.973	0.777	0.581	0.385	0.189	-0.007	-0.203	-0.394	-0.570	-0.731	-0.878	-1.010	-1.126	-1.228	-1.315	-1.387	-1.444	-1.486	-1.513	-1.525	-1.523	-1.505	-1.474	-1.441	-1.407	-1.374	-1.341	-1.307	-1.274

LONGITUDINAL SECTION
SCALES HORIZ. 1:1000, VERT :100

PRELIMINARY

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0 10 20 30m
SCALE 1:1000 AT ORIGINAL SIZE

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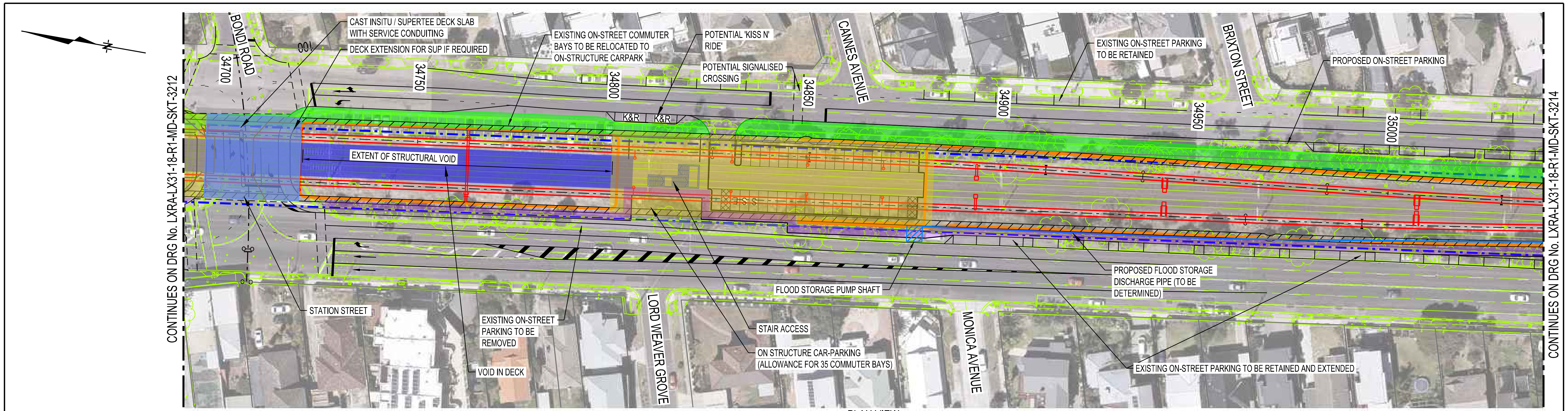
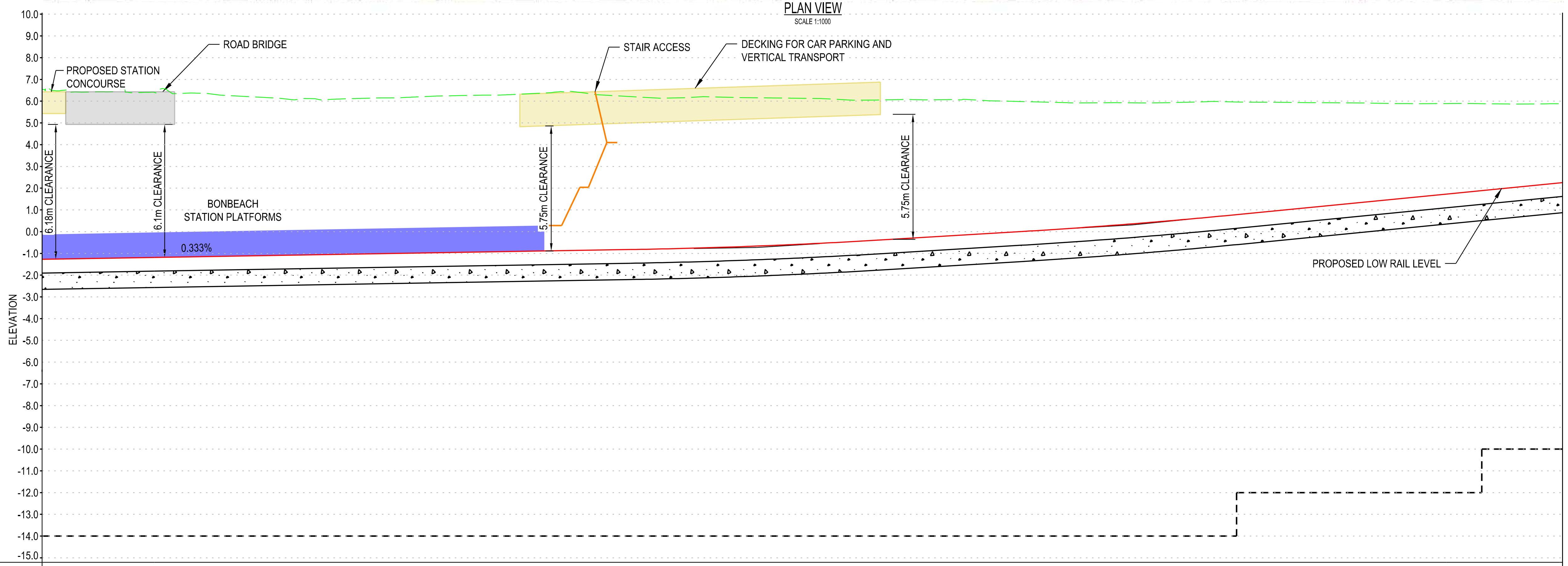
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 2 OF 4
Original Size A3 Drg No: LXRA-LX31-46-R1-MD-SKT-3212 Rev: A



PLAN VIEW

SCALE 1:1000



LONGITUDINAL SECTION

SCALES HORIZ. 1:1000, VERT :100

EXISTING TRACK LEVEL (m)	6.417	6.401	6.348	6.305	6.183	6.111	6.113	6.150	6.226	6.269	6.319
PROPOSED TRACK LEVEL (m)	-1.241	-1.208	-1.174	-1.141	-1.108	-1.074	-1.041	-1.008	-0.974	-0.941	-0.908

EXISTING TRACK LEVEL (m)	6.432	6.275	6.161	6.182	6.170	6.146	6.114	6.049	6.076	6.069	6.010
PROPOSED TRACK LEVEL (m)	-0.875	-0.841	-0.806	-0.759	-0.697	-0.619	-0.527	-0.420	-0.301	-0.181	-0.061

EXISTING TRACK LEVEL (m)	5.963	5.921	5.926	5.936	5.990	5.951	5.936	5.921	5.897	5.889	5.889	5.867
PROPOSED TRACK LEVEL (m)	0.061	0.195	0.344	0.508	0.687	0.880	1.076	1.272	1.468	1.664	1.860	2.056

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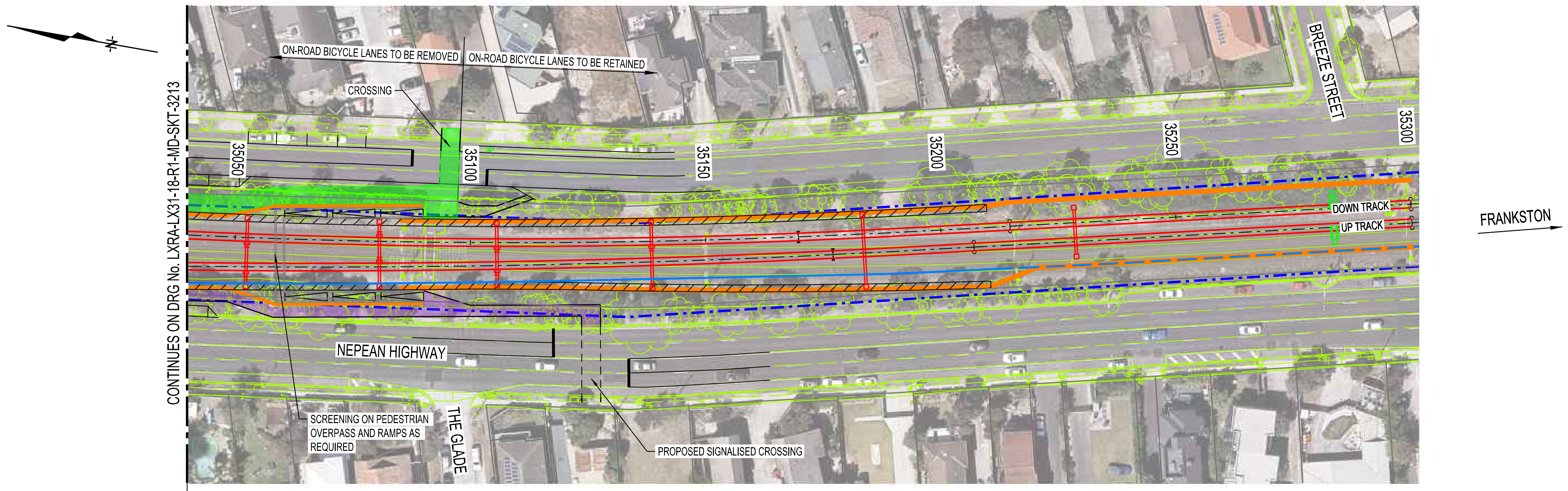
Client LEVEL CROSSING REMOVAL AUTHORITY
Project LX31 - SITE 46 - STATION STREET, BONBEACH
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 3 OF 4

Original Size A3 Drg No: LXRA-LX31-46-R1-MD-SKT-3213 Rev: A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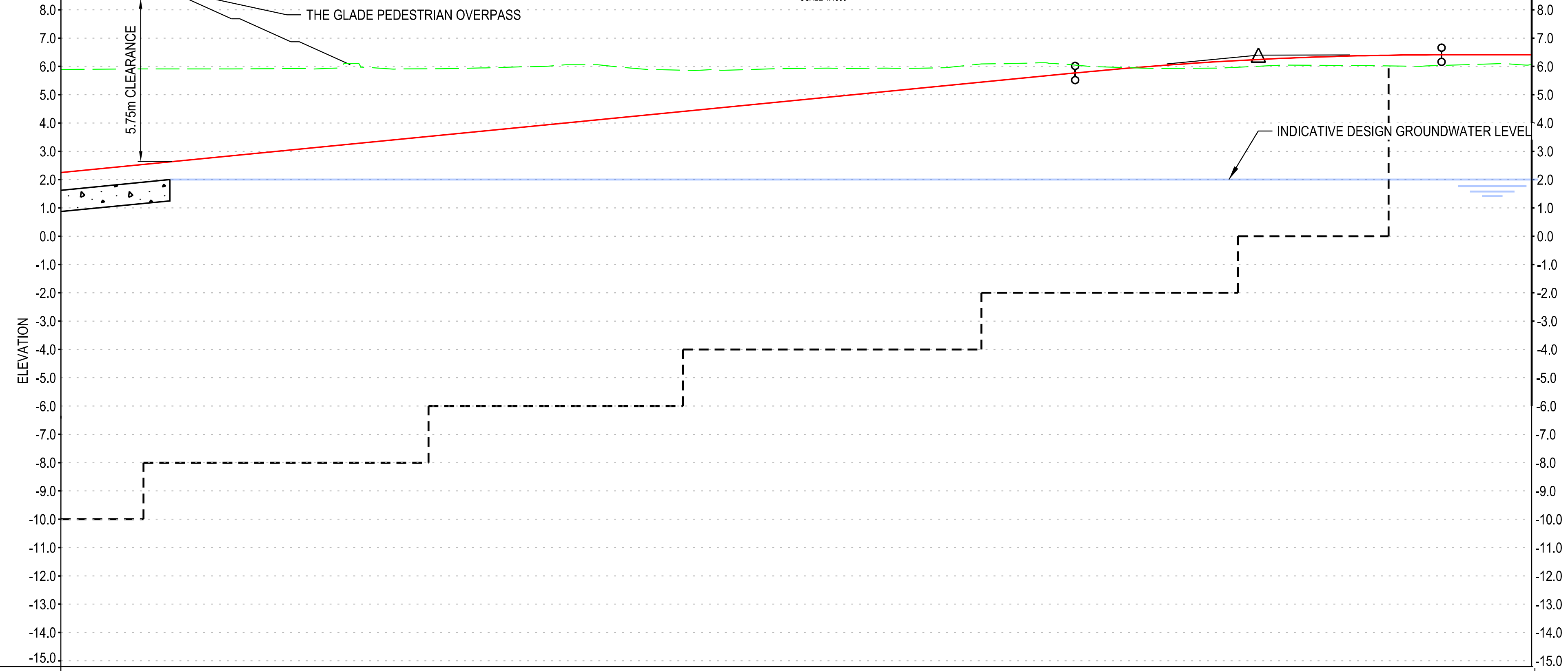
ON-ROAD BICYCLE LANES TO BE REMOVED
ON-ROAD BICYCLE LANES TO BE RETAINED
CROSSING
35050
35100
35150
35200
35250
35300
BREEZE STREET
DOWN TRACK
UP TRACK
FRANKSTON
NEPEAN HIGHWAY
SCREENING ON PEDESTRIAN OVERPASS AND RAMPS AS REQUIRED
THE GLADE
PROPOSED SIGNALISED CROSSING

PLAN VIEW
SCALE 1:1000



EXISTING TRACK LEVEL (m)	[illegible]	5.908	5.909	5.911	5.925	6.079	5.915	5.926	5.974	6.057	5.953	5.864	5.881	5.927
PROPOSED TRACK LEVEL (m)	[illegible]	2.448	2.644	2.840	3.036	3.232	3.428	3.624	3.820	4.016	4.212	4.408	4.604	4.800

EXISTING TRACK LEVEL (m)	5.928	5.933	6.031	6.109	6.034	5.947	5.931	5.989	6.041	6.030	6.006	6.072	6.067
PROPOSED TRACK LEVEL (m)	4.996	5.192	5.388	5.584	5.780	5.959	6.108	6.227	6.317	6.377	6.406	6.411	6.414

LONGITUDINAL SECTION
SCALES HORIZ. 1:1000, VERT :100

LEGEND

—·—·—	PROPOSED BG TRACK
— CSR — CSR —	PROPOSED UNDERGROUND RAIL SIGNALLING & POWER SERVICES
🟩	PROPOSED SHARED USE PATH
🟦	PROPOSED RAIL PLATFORM
⬜	PROPOSED DECK FOR ROAD BRIDGE
🟨	DECK FOR CAR PARKING, STATION, CONCOURSE AND / OR DEVELOPMENT
▨	PROPOSED RETAINING WALL
—	EXISTING FEATURE SURVEY
—	EXISTING CADASTRAL BOUNDARY
- · - · -	PROPOSED EASEMENT
—·—·—	VICTRACK RAIL RESERVE BOUNDARY
○	PROPOSED SIGNAL
▭	OVERHEAD WIRING SINGLE MAST
▭—▭	OVERHEAD WIRING GANTRY
—/—/—/—	PROPOSED FENCE
—	CONCRETE BARRIER - MEDIUM CONTAINMENT (WITH FENCE/SCREEN)

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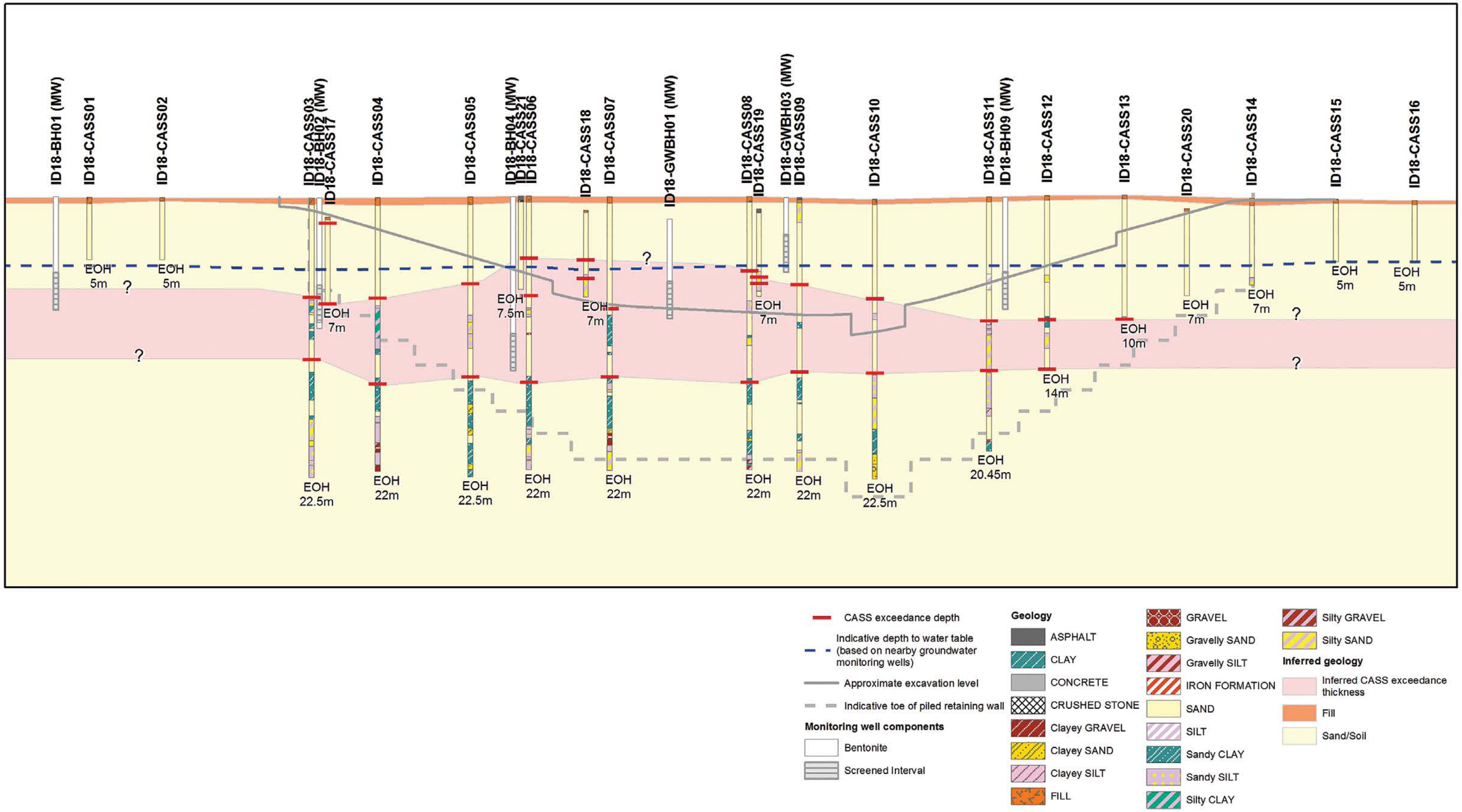
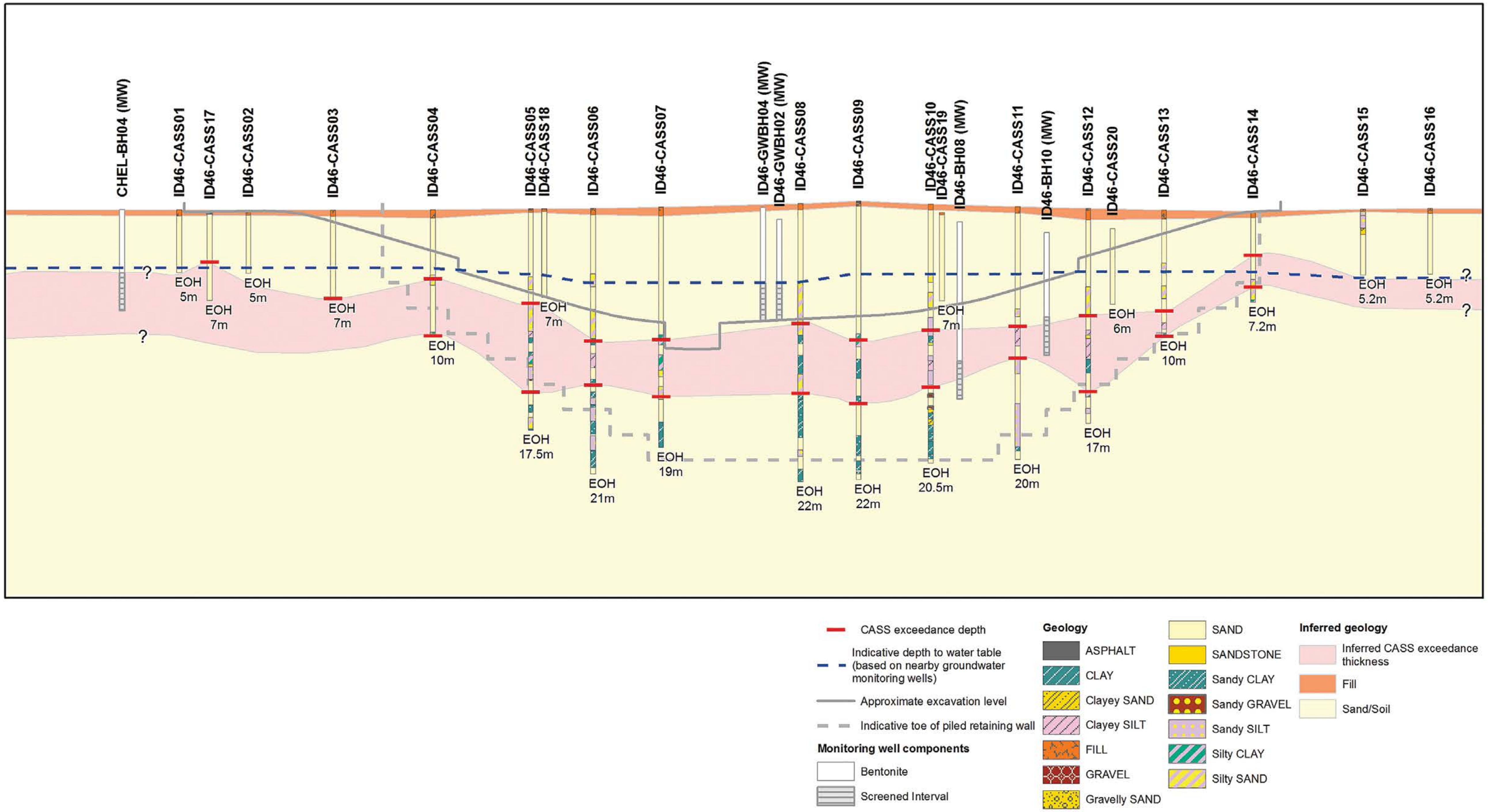
Project LX31 - SITE 46 - STATION STREET, BONBEACH
Title RAIL UNDER ROAD
PLAN AND LONG SECTION SUPPORTING EES REPORT - SHEET 4 OF 4
Original Size A3 Drg No: LXRA-LX31-46-R1-MD-SKT-3214 Rev: A

Figure 7.2 Potential waste acid sulfate soils (Edithvale)



Graphics showing inferred fill/CASS exceedance/sand/soil are indicative only

Figure 7.3 Potential waste acid sulfate soils (Bonbeach)



Graphics showing inferred fill/CASS exceedance/sand/soil are indicative only

Figure 7.6 Geotechnical borehole locations and indicative depth to CASS (Edithvale)

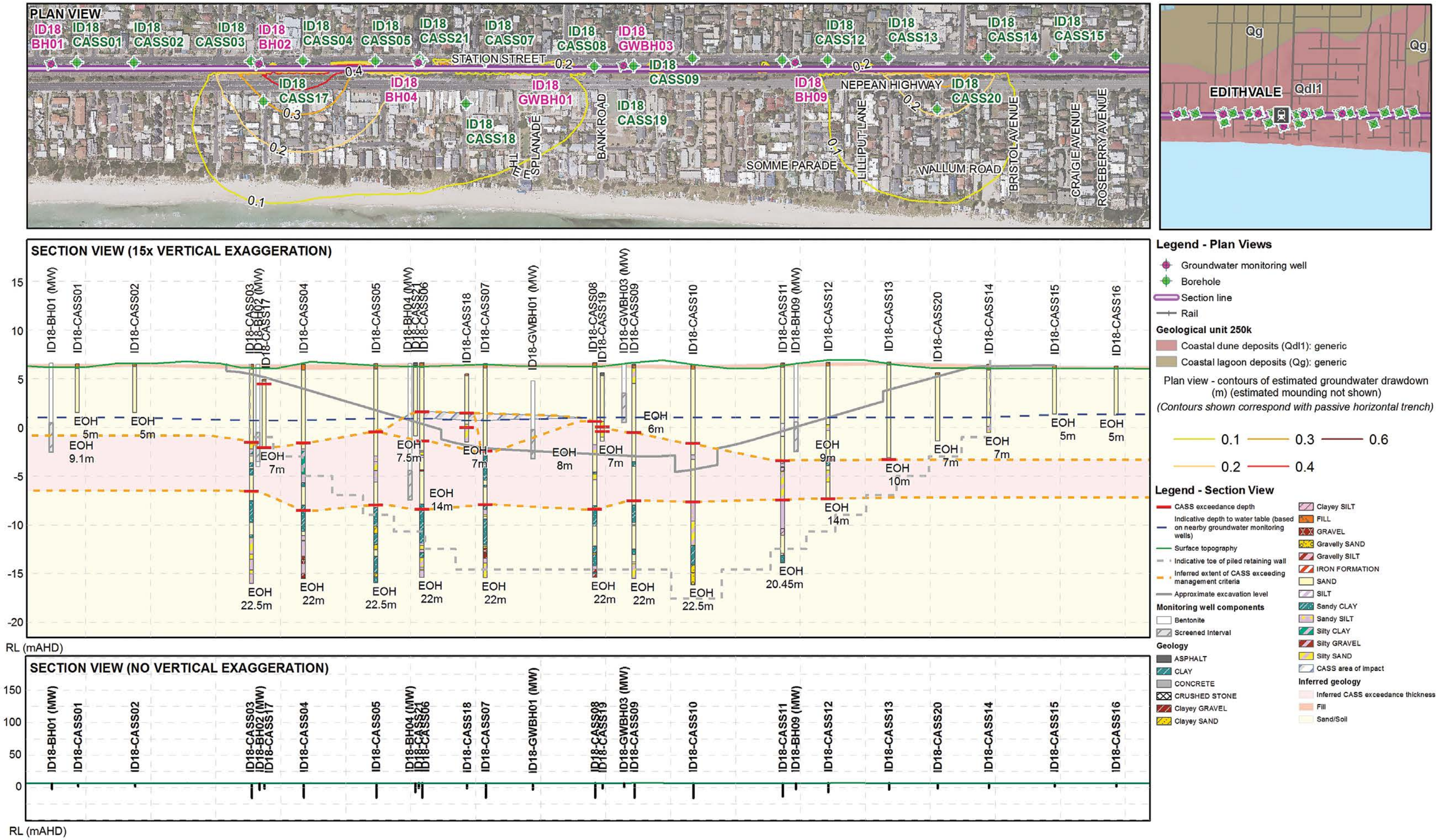
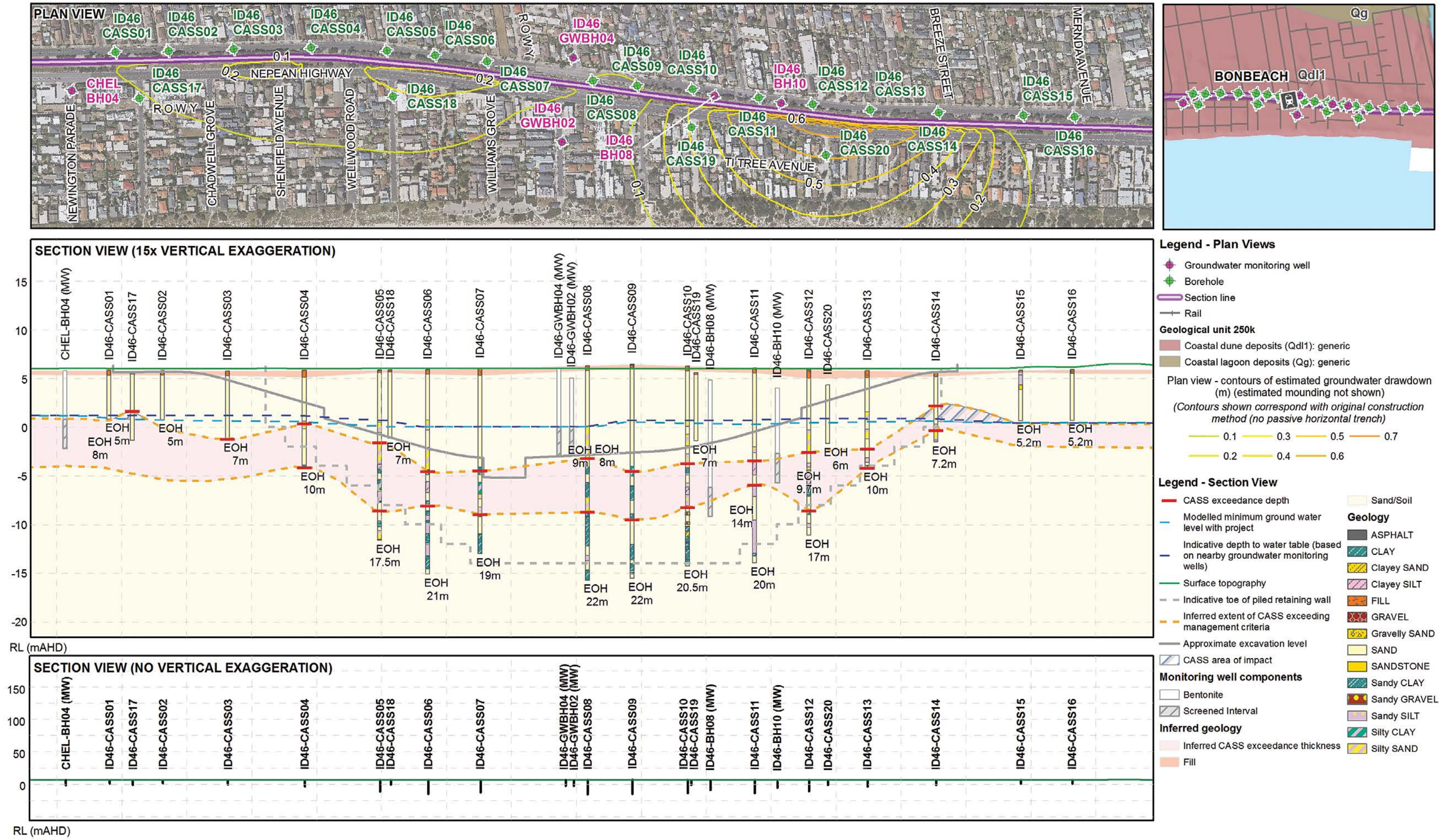


Figure 7.7 Geotechnical borehole locations and indicative depth to CASS (Bonbeach)



LEVEL CROSSING REMOVAL PROJECT

LEVEL CROSSING REMOVAL AUTHORITY

EDITHVALE ROAD, EDITHVALE

URBAN DESIGN GUIDELINES

DRAFT

27/02/2018

VERSION C

AECOM GHD

JOINT VENTURE

VICTORIA State Government

LXRA-LX31-18-UD-RPT-1001

#	ROLES AND RESPONSIBILITIES		STATUS	DATE	NOTES
1	PROJECT DIRECTOR	A			
2	DIRECTOR - ENGINEERING AND PROGRAM SERVICES	C			
3	SENIOR PROJECT MANAGER (FOR SITE)	R			
4	UDAP WORKING GROUP	E			
5	MANAGER - TECHNICAL SERVICES	C			
6	PROGRAM WIDE PLANNING AND ENVIRONMENT SPECIALIST	C			
7	ACTIVE TRANSPORT - TRAFFIC ENGINEER	C			
8	DEVELOPMENT MANAGER	C			

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RACI MATRIX	
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Consulted (C)	The individual(s) to be consulted prior to a final decision or action being taken.
Endorse (E)	The individual(s) who need(s) to endorse key decisions, actions or deliverables.
Accountable (A)	The individual who is ultimately accountable, including yes/no authority and power of veto.
Informed (I)	The individual(s) who need(s) to be informed after a decision or action is taken.

Document Status

PMF Classification			
TRIM Folder	FOL/16/48141	Version	0
Issue date	27/02/2018	Status	Final
Owner	LXRA	Approver	

Version Control

Version	Date	Author	Title	Description of change
C	02/02/2018	JV	Draft Urban Design Guidelines	

Approval

Version	Issue date	Approved by	Title

WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

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WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

1.0

INTRODUCTION

1.1 PROJECT BACKGROUND

1.2 PROJECT SUMMARY

1.3 DOCUMENT PURPOSE

1.4 DOCUMENT STRUCTURE

1.5 METHODOLOGY

1.6 URBAN DESIGN FRAMEWORK

1. INTRODUCTION

1.1 PROJECT SUMMARY

By 2022, the Level Crossing Removal Authority (LXRA) will oversee the removal of 50 dangerous and congested level crossings across Melbourne and perform vital rail corridor upgrades, including rail extensions and duplication works (refer to Figure 1).

The Level Crossing Removal Program is designed to:

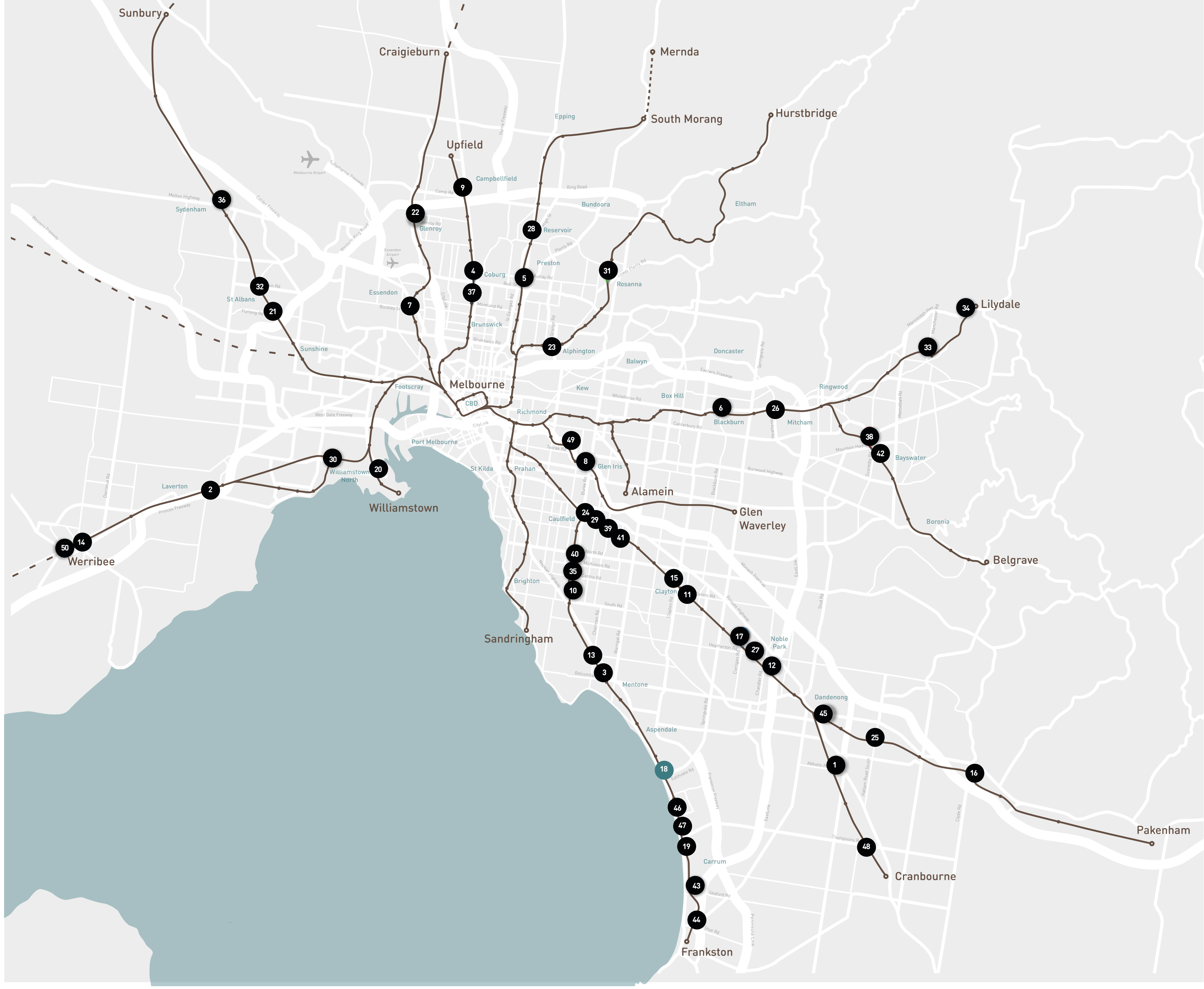
- Improve the reliability and efficiency of transportation networks, through reducing overall congestion;
- Enhance the urban amenity of local areas; and
- Create safer, better connected, liveable and thriving communities.

The LXRA was formed in May 2015 to oversee the delivery of the project and to ensure that level crossings are removed in a coordinated and efficient manner. LXRA's vision is *'delivering great change, by transforming the way Victorians live, work and travel'*. This vision is underpinned by 5 strategic objectives, including a commitment to creating great places.

LXRA and the AECOM-GHD Joint Venture (Technical Advisor), have led site investigations, functional and reference design packages, and the preparation of associated requirements and guidelines, to support the removal of level crossings at each nominated location. Stakeholder engagement and community consultation is an important part of this process, to ensure that stakeholder and community considerations are suitably addressed in the design and delivery of the project.

Further design development, construction and delivery works are now being delivered by LXRA through Program Alliance partnerships with leading industry specialists. Design and construction works for each site have been prioritised and staged to ensure that critical crossings are addressed as a priority and transport route delays and other impacts are minimised.

This project has the potential to set strong benchmarks and act as a catalyst for positive urban renewal that reinvigorates and reconnects communities. In order to create a lasting legacy, innovative and high quality urban design is key to the success of the project.



ALTONA LOOP
30 Kororoit Creek Road, Williamstown North

BELGRAVE
38 Mountain Highway, Bayswater
42 Scoresby Road, Bayswater

CRAIGIEBURN
7 Buckley Street, Essendon
22 Glenroy Road, Glenroy

CRANBOURNE
1 Abbotts Road, Dandenong South
48 Thompsons Road, Lyndhurst

FRANKSTON
40 North Road, Ormond
3 Balcombe Road, Mentone
10 Centre Road, Bentleigh
13 Charman Road, Cheltenham
18 Edithvale Road, Edithvale
19 Eel Race Road, Carrum
35 McKinnon Road, McKinnon
43 Seaford Road, Seaford
44 Skye Road, Frankston
46 Station Street, Bonbeach
47 Station Street, Carrum

GLEN WAVERLEY
8 Burke Road, Glen Iris
49 Toorak Road, Kooyong

HURSTBRIDGE
23 Grange Road, Alphington
31 Lower Plenty Road, Rosanna

LILYDALE
6 Blackburn Road, Blackburn
26 Heatherdale Road, Ringwood
33 Manchester Road, Mooroolbark
34 Maroondah Highway, Lilydale

PAKENHAM
11 Centre Road, Clayton
15 Clayton Road, Clayton
29 Koornang Road, Carnegie
39 Murrumbeena Road, Murrumbeena
12 Chandler Road, Noble Park
17 Corrigan Road, Noble Park
24 Grange Road, Carnegie
27 Heatherton Road, Noble Park
41 Poath Road, Hughesdale
16 Clyde Road, Berwick
25 Hallam Road South, Hallam
45 South Gippsland Highway, Dandenong

SOUTH MORANG
5 Bell Street, Preston
28 High Street, Reservoir

SUNBURY
32 Main Road, St Albans
21 Furlong Road, St Albans
36 Melton Highway, Sydenham

UPFIELD
4 Bell Street, Coburg
9 Camp Road, Campbellfield
37 Moreland Road, Brunswick

WERRIBEE
2 Aviation Road, Laverton
14 Cherry Street, Werribee
50 Werribee Street, Werribee

WILLIAMSTOWN
20 Ferguson Street, Williamstown

*Not in priority order

Disclaimer: Sites are numbered for identification purposes only. Numbering does not indicate order of removal.

Figure 1: Level Crossing Removal - Project Map

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1.2 SITE OVERVIEW

This Urban Design Guidelines Report has been prepared for the Edithvale Road, Edithvale Level Crossing Removal Project in Edithvale.

Edithvale Road runs from the Nepean Highway to Wells Road, where it becomes Springvale Road, and cuts through a busy residential area. It is also the main thoroughfare for a local school, recreation areas, a public golf course, and the Seaford/Edithvale Wetlands.

The level crossing at Edithvale Road is located between Station Street and the Nepean Highway. The boom gates are down for an average of 42 minutes during the weekday peak (between 7:00am and 9:00am), impacting travel times for more than 12,000 motorists who travel over this level crossing everyday. The existing level crossing also poses a danger to pedestrians moving along and through Edithvale Road.

The Edithvale Road, Edithvale Level Crossing Removal project will be delivered by the Southern Program Alliance.

1.3 DOCUMENT PURPOSE

The purpose of this Urban Design Guidelines (UDGs) document is to illustrate and describe the key urban design objectives and outcomes sought for the Edithvale Road, Edithvale Level Crossing Removal Project.

The Urban Design Guidelines have been prepared to build on the principles, objectives, measures and benchmarks of the LXRA Urban Design Framework (UDF). It outlines site specific urban design requirements the design is to achieve by:

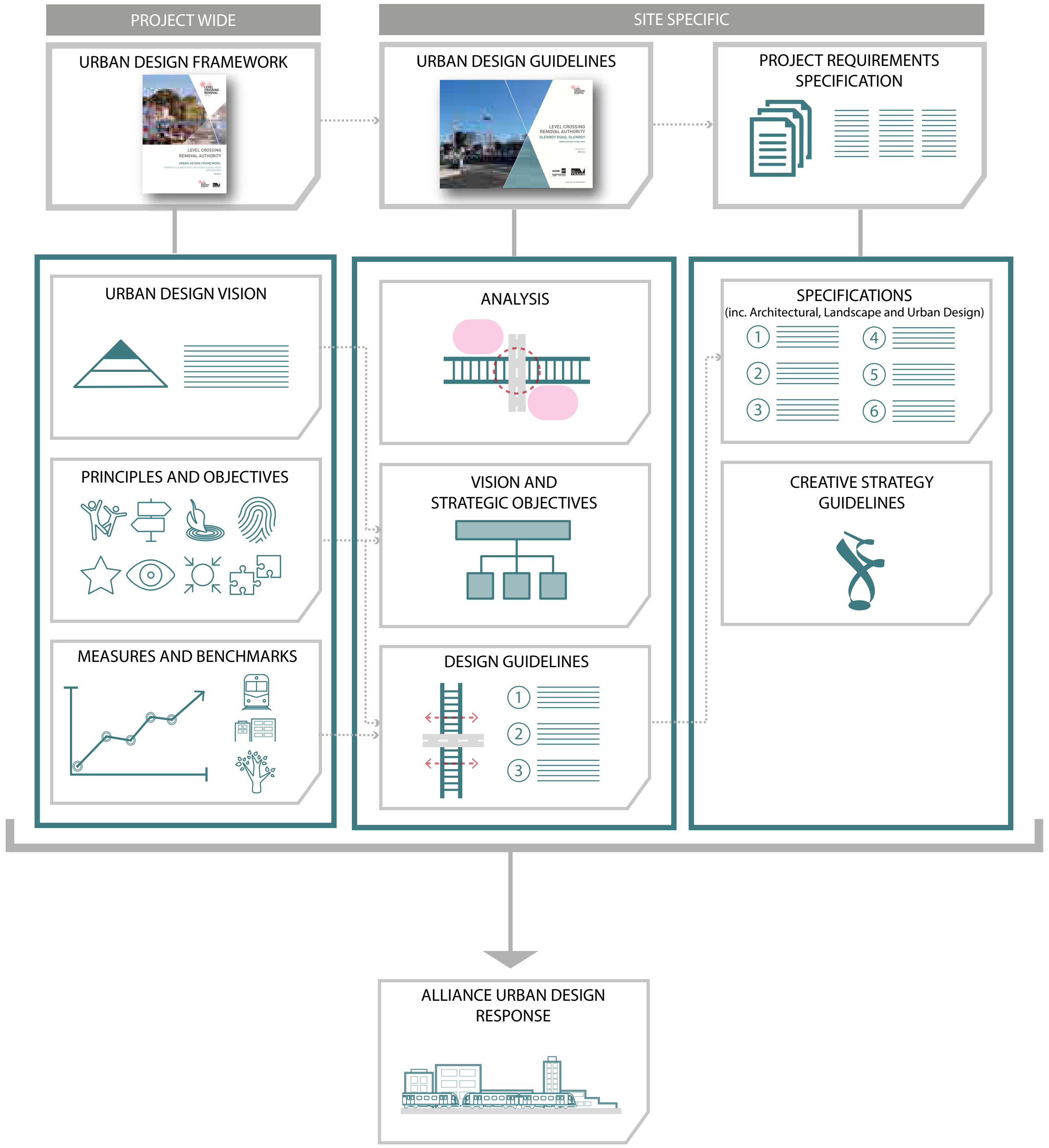
- Identifying key issues and opportunities for improving connectivity, amenity, functionality and place-making for the site and surrounding precinct;
- Articulating the broader urban design vision and strategic objectives for the site; and
- Establishing guidelines for the project, according to the urban design principles.

Further detailed urban design specifications also form part of the Project Requirements Specification (PRS).

The strategic objectives and guidelines set out by this document consider the management and mitigation of project risks that have been identified as part of the Environmental Effects Statement (EES) process for the Edithvale and Bonbeach sites. As such, the UDGs have been incorporated into the Environmental Performance Requirements (EPRs).

The analysis of policy and the existing context areas contained within this document should be read in conjunction with other relevant EES reports.

Figure 2: Urban Design Requirements


PROJECT WIDE
SITE SPECIFIC
URBAN DESIGN FRAMEWORK
URBAN DESIGN GUIDELINES
PROJECT REQUIREMENTS SPECIFICATION
URBAN DESIGN VISION
PRINCIPLES AND OBJECTIVES
MEASURES AND BENCHMARKS
ANALYSIS
VISION AND STRATEGIC OBJECTIVES
DESIGN GUIDELINES
1
2
3
SPECIFICATIONS
(inc. Architectural, Landscape and Urban Design)
1
2
3
4
5
6
CREATIVE STRATEGY GUIDELINES
ALLIANCE URBAN DESIGN RESPONSE

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1.4 DOCUMENT STRUCTURE

The Urban Design Guidelines document is structured in six (6) main parts, as outlined below:

SECTION 1: INTRODUCTION

Section 1 provides a summary of background information about the Level Crossing Removal Project and site.

SECTION 2: STRATEGIC PLANNING AND POLICY ANALYSIS

Section 2 identifies relevant state, local and project specific plans, policies and strategies, noting relevant implications for the site.

SECTION 3: CONTEXT ANALYSIS

Section 3 examines the existing site conditions, at a local and regional level and why this is important for the project.

SECTION 4: COMMUNITY AND STAKEHOLDER ENGAGEMENT

Section 4 presents the key considerations and themes that have emerged from stakeholder engagement and community consultation.

SECTION 5: ISSUES AND OPPORTUNITIES

Section 5 summarises issues and opportunities for the site and precinct, based on the preceding analysis and consultation outcomes.

SECTION 6: DESIGN GUIDELINES

Section 6 outlines the overall vision, strategic objectives and design guidelines for the project site which are site specific requirements that Alliance teams must address as part of their design response.

1.5 METHODOLOGY

The methodology and approach that has been taken in preparing the following guidelines, is illustrated in Figure 3.

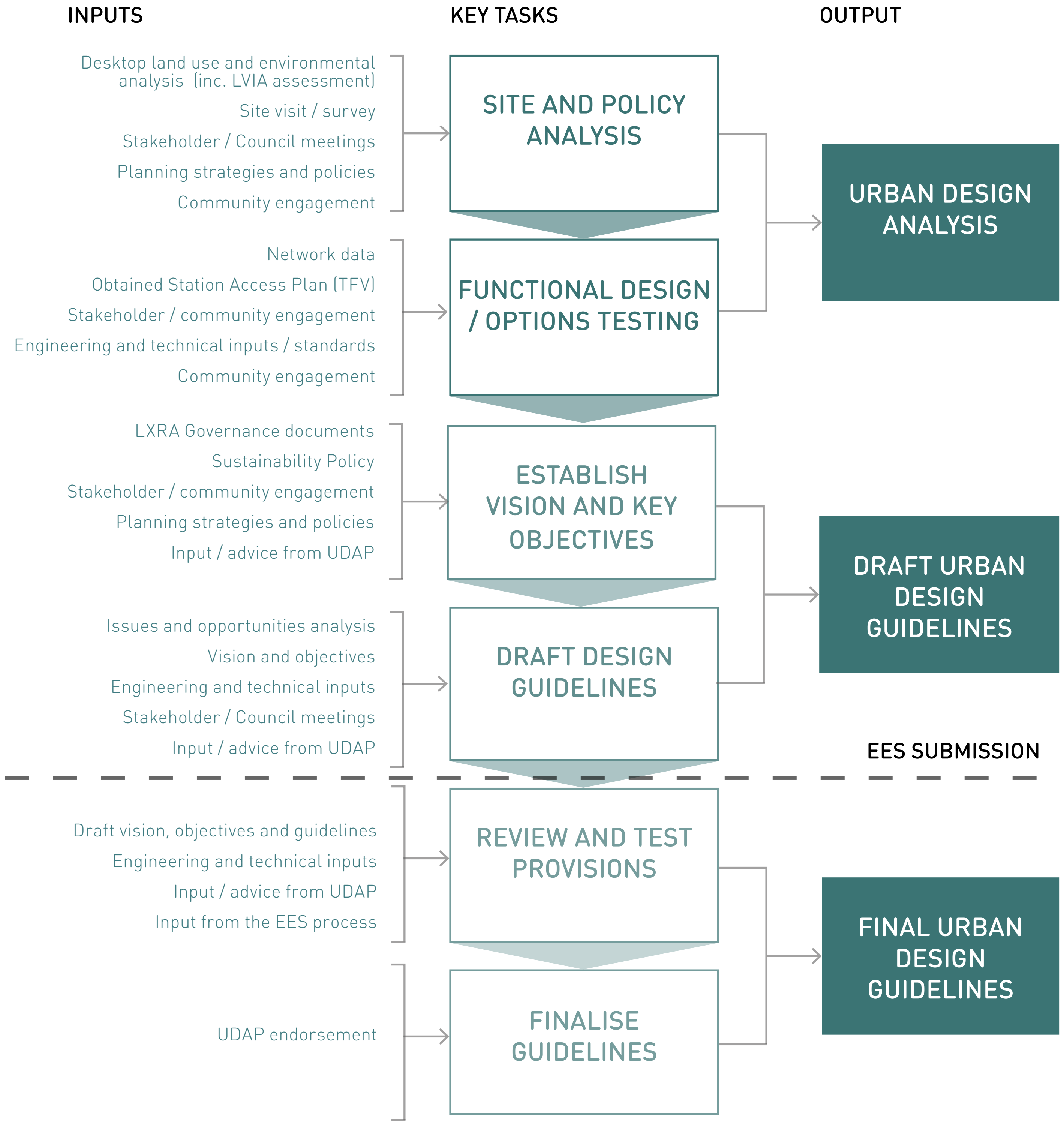
A number of workshops, technical inputs and data sources have been used to inform the guidelines, including:

- Urban Design Advisory Panel (UDAP) and working group sessions;
- Council and key stakeholder workshops;
- Landscape and visual impact assessment (LVIA)
- Civil and transport engineering inputs, including traffic and movement analysis;
- Rail and structural engineering advice;
- Ground engineering and geotechnical engineering;
- Planning and environmental analysis; and
- Advice in relation to utility engineering, fire life safety and building services.

Periodic review and input from UDAP has been obtained throughout the development of the guidelines, to ensure the provisions satisfy the objectives and interests of the State.

This document has been prepared in conjunction with the LXRA Urban Design Advisory Panel (UDAP). UDAP comprises members from across government with specific professional expertise in architecture, urban design, strategic planning, transport planning and landscape architecture.

Figure 3: Methodology


INPUTS
KEY TASKS
OUTPUT
Desktop land use and environmental analysis (inc. LVIA assessment)
Site visit / survey
Stakeholder / Council meetings
Planning strategies and policies
Community engagement
SITE AND POLICY ANALYSIS
Network data
Obtained Station Access Plan (TFV)
Stakeholder / community engagement
Engineering and technical inputs / standards
Community engagement
FUNCTIONAL DESIGN / OPTIONS TESTING
URBAN DESIGN ANALYSIS
LXRA Governance documents
Sustainability Policy
Stakeholder / community engagement
Planning strategies and policies
Input / advice from UDAP
ESTABLISH VISION AND KEY OBJECTIVES
Issues and opportunities analysis
Vision and objectives
Engineering and technical inputs
Stakeholder / Council meetings
Input / advice from UDAP
DRAFT DESIGN GUIDELINES
DRAFT URBAN DESIGN GUIDELINES
EES SUBMISSION
Draft vision, objectives and guidelines
Engineering and technical inputs
Input / advice from UDAP
Input from the EES process
REVIEW AND TEST PROVISIONS
UDAP endorsement
FINALISE GUIDELINES
FINAL URBAN DESIGN GUIDELINES

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1.6 URBAN DESIGN FRAMEWORK

The LXRA Urban Design Framework outlines the expectations for achieving high quality, context sensitive urban design outcomes for each project. The document plays a dual role by informing the design process as well as providing a basis for the evaluation of design solutions.

The Framework identifies eight key principles inherent to successful major infrastructure projects (see Figure 4). Stemming from these principles are the urban design objectives which outline what the project should achieve in relation to the broader principles.

Performance measures and benchmarks are also identified in the Framework. They describe more specific requirements that the design must meet and include qualitative benchmark examples that illustrate the level of quality, materials and finishes that are expected.

The measures and benchmarks section of the Framework shall apply in addition to requirements set out in this guidelines document.

Principle 1

IDENTITY

A well defined identity and sense of place are key to creating strong and vibrant communities.

Principle 2

CONNECTIVITY & WAYFINDING

Well connected and legible places contribute significantly to strong economies and healthy, inclusive communities.

Principle 3

URBAN INTEGRATION

Well-integrated environments provide a sound framework for the successful development of great places.

Principle 4

RESILIENCE & SUSTAINABILITY

Places must be sustainable, enduring and resilient in order to support and nurture current and future generations.

Principle 5

AMENITY

High quality urban amenity associated with access to services and the experience of great public places contributes to successful, equitable and prosperous communities.

Principle 6

VIBRANCY

Animation of key civic spaces, and diversity in the experience of urban places support prosperous and healthy communities.

Principle 7

SAFETY

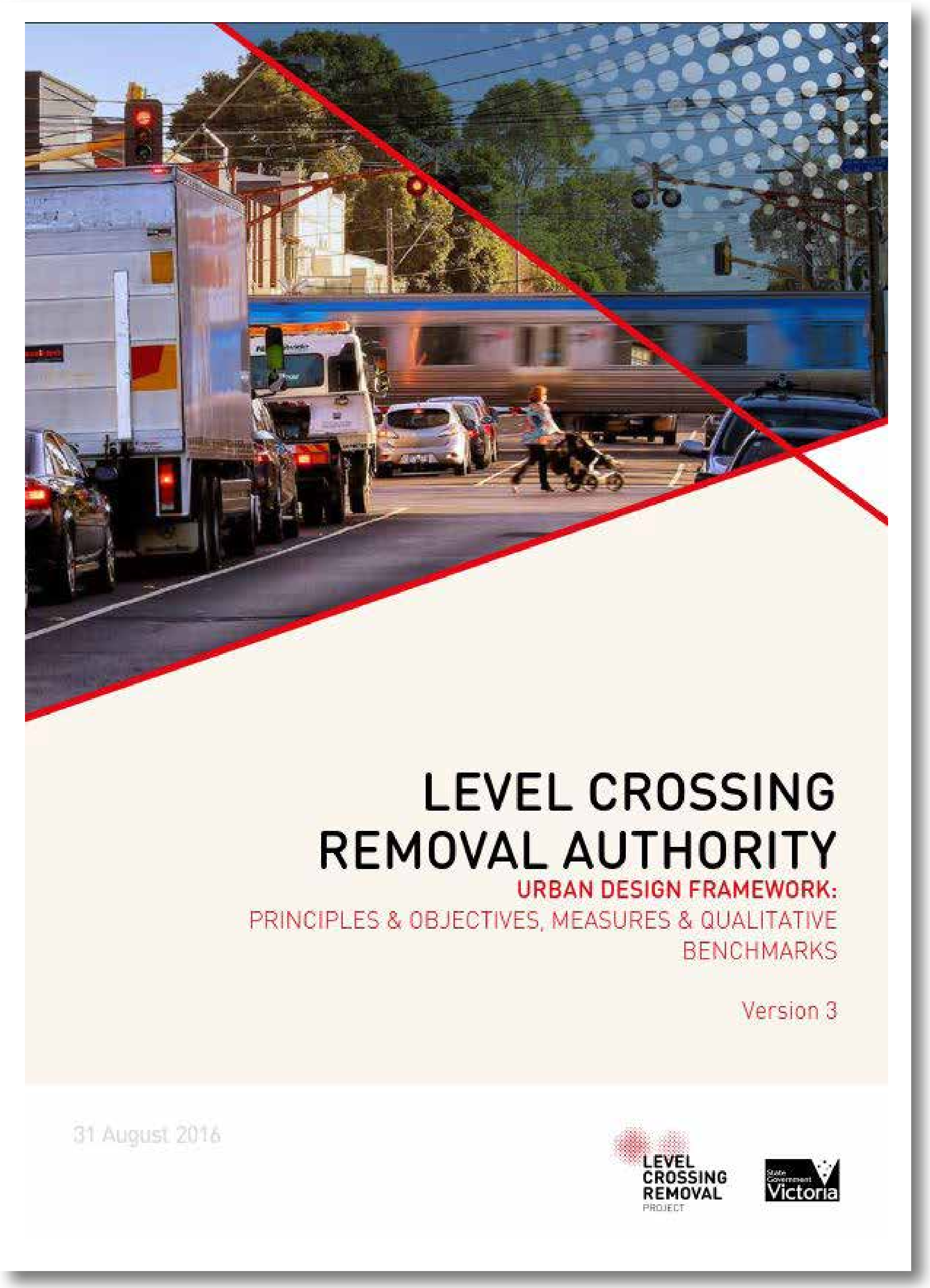
Safe environments are essential for strong, connected and happy communities

Principle 8

ACCESSIBILITY

Highly accessible and inclusive environments encourage positive activation and contribute to prosperity, well being and the perception of care within communities.

Figure 4: Urban Design Framework



LEVEL CROSSING
REMOVAL AUTHORITY
URBAN DESIGN FRAMEWORK:
PRINCIPLES & OBJECTIVES, MEASURES & QUALITATIVE BENCHMARKS

Version 3

31 August 2016

LEVEL CROSSING REMOVAL PROJECT

State Government Victoria

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WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

2.0

CONTEXT ANALYSIS

2.1 REGIONAL CONTEXT

2.2 HISTORICAL CONTEXT

2.3 LOCAL CONTEXT

2.4 DEMOGRAPHICS

2.5 PHOTOGRAPHIC SURVEY

2. CONTEXT

2.1 GEOGRAPHIC CONTEXT

The southern end of the Frankston Rail Corridor predominantly comprises of residential neighbourhoods. The Edithvale-Seaford Wetlands are located to the east of the rail corridor and are listed as internationally important. There are over 100 different species of birds regularly spotted in the wetland systems, including species of migratory birds from the northern hemisphere.

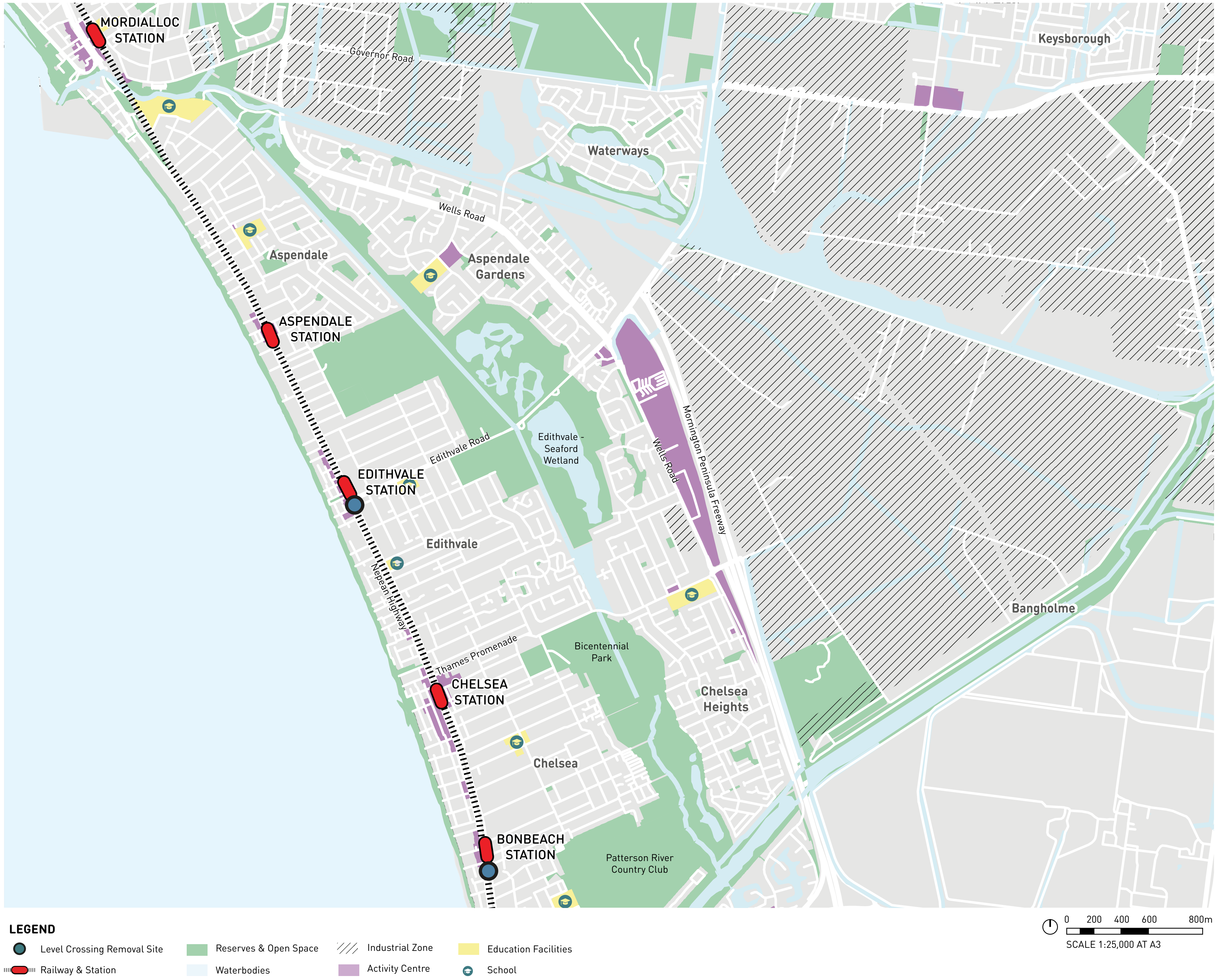
The Frankston Rail Corridor runs through an urbanised area with a mix of building types varying in height and setbacks. The area saw an increase in development during and after the Second World War. Buildings are typically of a suburban scale and style with recent infill redevelopment introducing sub-divided properties, townhouses, and small apartment buildings.

The Edithvale Road site sits within the City of Kingston, 28 kilometres south-east of Melbourne's CBD along the Frankston Rail Corridor. Travel time via rail from Edithvale Station is approximately 50 minutes to the city, and 15 minutes to Frankston Station. The rail corridor runs parallel to Nepean Highway from Mordialloc to Carrum, creating a barrier for east-west movement. A number of arterial roads intersect the corridor providing road access to surrounding residential areas, and key employment destinations via the Mornington Peninsula Freeway and Eastlink.

The corridor traverses a mix of open space amenities including parklands, narrow linear reserves, sports fields, playgrounds, and golf courses. Vegetation mitigates visual impacts and provides green links along most of the rail corridor contributing to the local landscape character. From Mordialloc, the rail corridor is located within close proximity to the coast line, where topography is flat and views to the beach are prominent. Shrubby, low lying coastal vegetation is predominant in this area.

The broader context surrounding the Edithvale site is illustrated in Figure 5.

Figure 5: Regional Context Map



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2.2 HISTORICAL CONTEXT

Figure 6: Historical Timeline

○ **1919**

EDITHVALE AS A SUBURB

Edithvale was recognised as a suburb separate from Aspendale and Chelsea.

● **1919**

EDITHVALE RAILWAY STATION

Edithvale station opened in September 1919 with a siding on the down side before Platform 2.

○ **1950**

EDITHVALE RESIDENTIAL GROWTH

Residential population rapidly increased with holiday houses converting to owner occupied dwellings.

○ **1960**

BEACH DEVELOPMENT

Coastals dunes removed to install sewerage and replanted with introduced creeping grasses.

● **1981**

EDITHVALE STATION REBUILT

The Edithvale Railway Station buildings were rebuilt.

○ **2016**

EDITHVALE LEVEL CROSSING

Commencement of project to remove the level crossing at Edithvale Road and create a new station at Edithvale.

● Year of significant historical event

○ Other events

The traditional owners and custodians of the land in and around Edithvale are the Bunurong people, members of the Kulin Nation. Europeans began farming the area in the 19th century and displaced local inhabitants. Edithvale was the last of five suburbs in the former Chelsea city to receive recognition as a suburb. It was treated as a locality shared by Aspendale and Chelsea until the 1920s.

The largest remnant wetlands in Edithvale were protected in 2001 receiving Ramsar classification. Combined with the adjoining Seaford wetland, the total Ramsar area is 261 ha.

Image 1: Edithvale - Seaford Wetlands

Prior to European settlement in the 19th century the geography of the area consisted of large sand dune complexes on the coast, and wetland areas inland.

Image 2: Edithvale Railway Station Opening

The station at Edithvale opened in September 1919, improving accessibility to the beach at Edithvale that was a popular destination for Melbourne residents. At-least half of the dwellings in Edithvale were holiday houses.

Image 3: Residential Growth

The population in Edithvale grew considerably post WWII as a result of affordability, proximity to the beach, and connectivity to Frankston and Melbourne CBD.

Image 4: Beach Development

In the 1960s the entire dune behind Edithvale beach was bulldozed, removing all native vegetation to install sewerage to beach front properties. The beach was planted with introduced grasses to hold the sand together, creating a n environment with creeping sand dune covering the beach.

Image 5: Edithvale Station Rebuilt

In 1981 the two station buildings at Edithvale Station were rebuilt to accommodate increased patronage from residential growth.

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2.3 LOCAL CONTEXT

LAND USE AND ACTIVITY

RESIDENTIAL

The land use immediately surrounding the Edithvale Road, Edithvale level crossing site is predominantly residential in nature. Lots are generally 500-700 square metres in size, developed in the post war era (1960s).

There has been little recent redevelopment and no significant intensification of housing in the area, which retains a predominately low lying coastal residential character.

COMMERCIAL / MIXED USE

The Edithvale Neighbourhood Centre serves the local area, and is located between larger activity centres including Chelsea to the south and Mordialloc to the north. The Neighbourhood Centre consists of small tenancies and a local supermarkets with retail shop fronts along the Nepean Highway. Local services and uses range from cafes, small shops, and personal and professional services.

Nepean Highway forms a continuous 'high street' environment for the Neighbourhood Centre with active street frontages of retail shops and overhead canopies.

COMMUNITY FACILITIES

A basic range of community facilities are located in the local area. This includes Edithvale Primary School, Edithvale Family and Children's Centre, and Edithvale Bowling Club. Edithvale Primary School sits 500m east (within walking distance) of Edithvale Station and services a local catchment.

The Edithvale Life Saving Club is a key community focal point, with the club incorporating a community room and a cafe. An aged care facility is located at Northcliffe Road.

OPEN SPACE AND RECREATION

The level crossing site is located within close proximity to a number of locally and regionally significant open spaces and recreational amenities, including Edithvale Beach and Port Phillip Foreshore. The Edithvale-Seaford Wetlands, Edithvale Common and golf courses are located to the east forming a cluster of regional open space and recreation destinations within the vicinity of the level crossing site.

Located in closer proximity to the station precinct, Regents Park and Edithvale Recreation Reserve provide passive and recreational facilities. Beeson Reserve is located adjacent to Edithvale Station and forms an important small open space link between the station, the foreshore, and lifesaving club.

Image 6: Uniting Church in Australia Chelsea

Image 7: Beeson Reserve

Image 8: Nepean Highway Neighbourhood Retail

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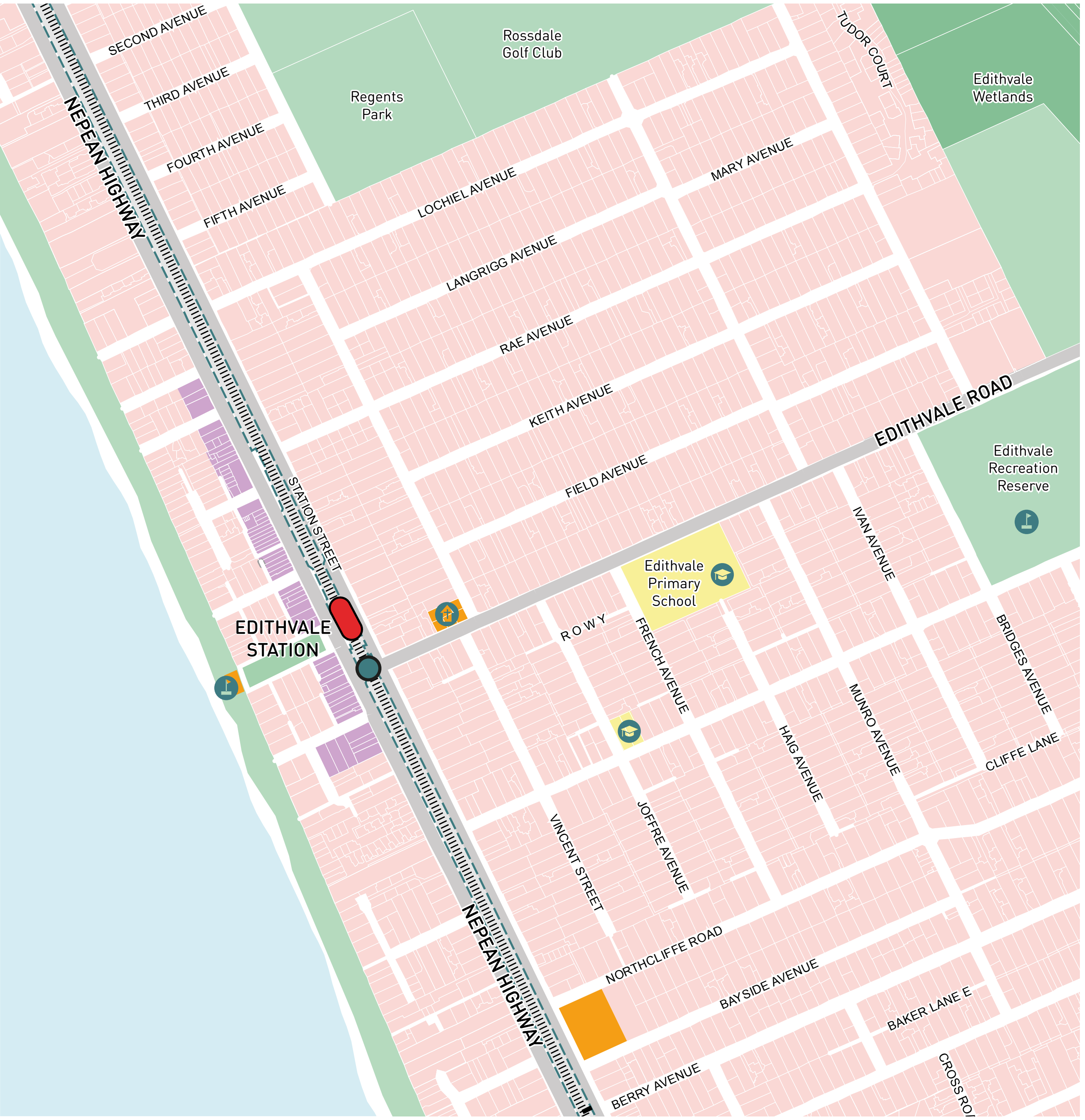
Figure 7 - Land Use Analysis Plan

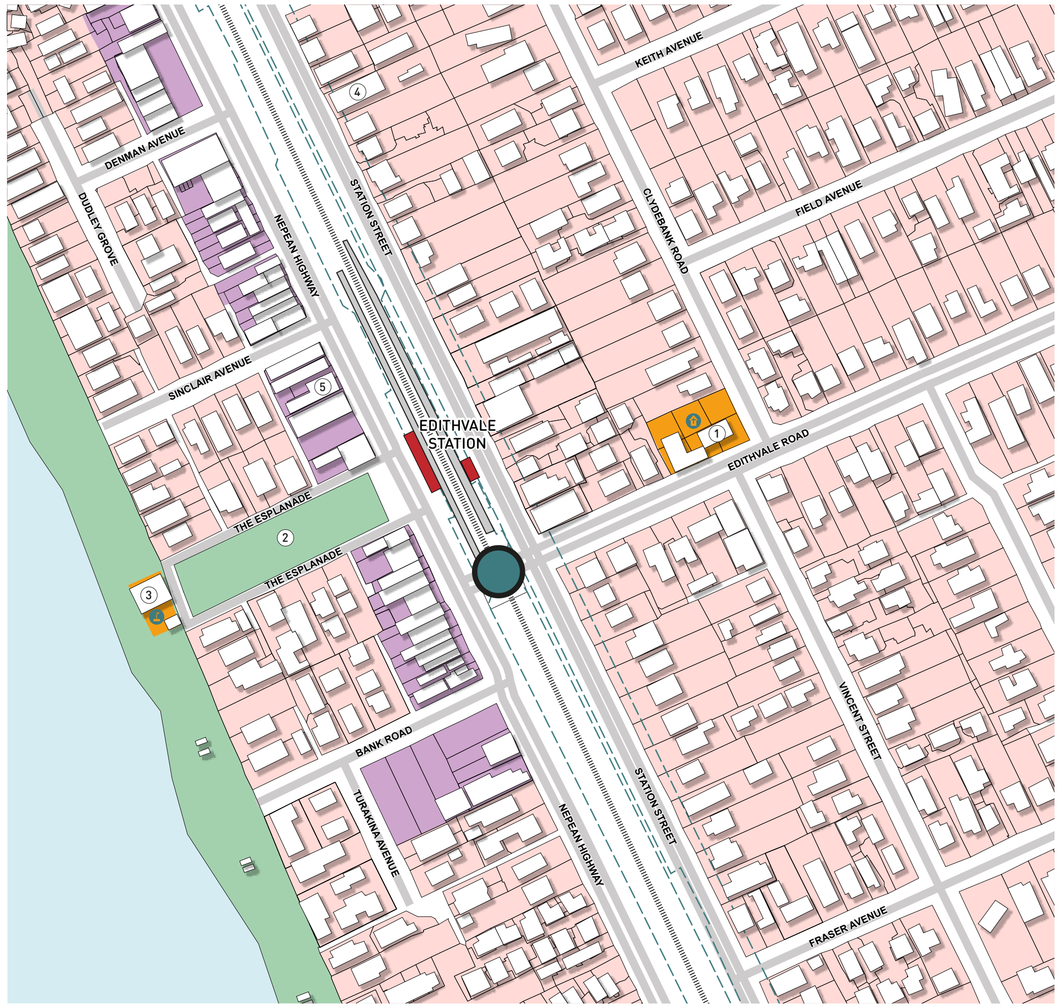


LEGEND

- ● Level Crossing Removal Site
- Railway & Station
- – – Victrack Boundary
- Major Roads
- Waterbodies
- Conservation Reserves
- Public Open Space & Recreation
- Community Uses - General
- Residential Area
- Neighbourhood Retail
- Education Facilities
- School
- Religious Facilities
- Sporting Facilities

0 40 80 160 240m
SCALE 1:8,000 AT A3

Figure 8 - Land Use Analysis Enlargement



LEGEND

- ● Level Crossing Removal Site
- Railway & Station
- ☐ Built Form
- Platform

SPECIFIC LAND USES

① Uniting Church in Australia Chelsea
② Beeson Reserve
③ Edithvale Lifesaving Club
④ Edithvale Fire Brigade
⑤ Edithvale Post Office

0 20 40 90 120m
SCALE 1:4,000 AT A3

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BUILT FORM AND HERITAGE

BUILT FORM CHARACTER

Retail and commercial areas are clustered to the west of Edithvale Station along the Nepean Highway. Built form is generally single or double storey in height and built to the front boundary.

Existing planning controls maintain a maximum building height of two storeys between the railway line and the foreshore. The Kingston Planning Scheme does not specify a maximum building height for land east of the railway line. Buildings on Nepean Highway and Station Street are predominantly one and two storeys.

Residential housing predominately interfaces the rail corridor at Edithvale. Constructed during the 1950s-1960s, dwellings are generally detached and single or double storey in height, even where redevelopment has occurred. Side and front built form setbacks create a well-landscaped coastal suburban character.

Residential interfaces with the railway beyond the Neighbourhood Centre are exclusively indirect (facing a street that interfaces with the railway line).

The Surf Life Saving building at the end of Beeson Reserve is a more recent two-storey local architectural landmark, responding to the local coastal environment through form and materials.

The existing Edithvale Railway Station building is functional in form. While the station is a local landmark along the Nepean Highway, the building itself is not identified as being of architectural or historical significance.

Small boat sheds and bathing boxes that have existed since the suburb's earliest days line the nearby beach. While modest in scale, and not directly adjacent to the rail corridor, they are an integral part of the neighbourhood identity.

HERITAGE

There are a few heritage sites of local significance within Edithvale. This includes the local primary school, and a few residential houses in the broader area, the Former Edithvale Cinema on Nepean Highway, and a circa 1910 heritage listed St Colombia's Anglican Church and Community Hall on Lochiel Avenue.

It is noted that the above buildings and sites are protected by Heritage Overlays and are not listed on the Victorian Heritage Register.

ABORIGINAL CULTURAL HERITAGE

There are two extensive areas of cultural heritage sensitivity in Edithvale. This includes coastal land within 200m of the high water mark, as well as the declared Ramsar Edithvale wetlands and surrounding 200m buffer area.

Image 9: Nepean Highway to Beach Built form

Image 10: Edithvale Beach Bathing Boxes

Image 11: 8-12 Lochiel Avenue Former Church

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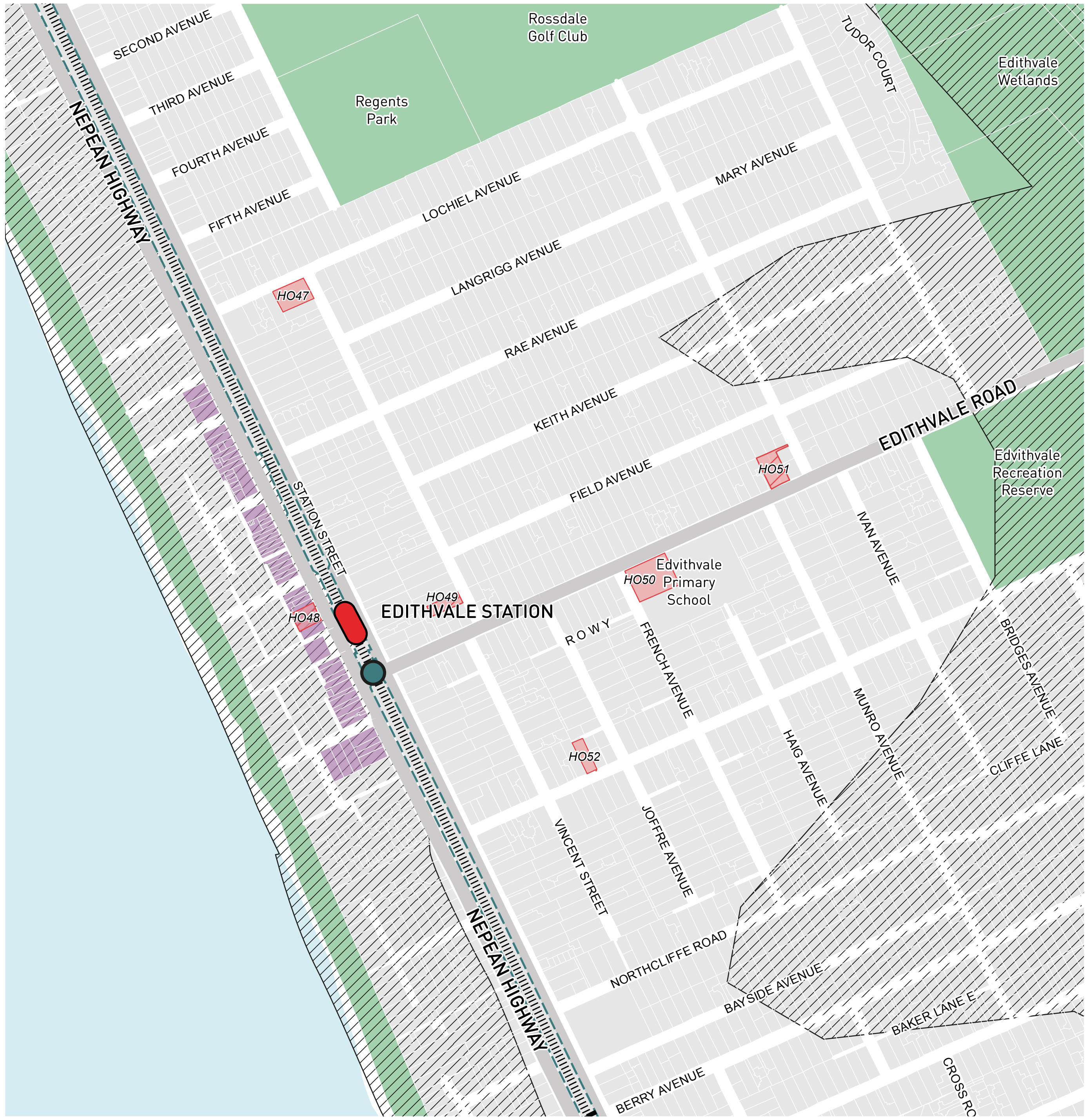
Figure 9 - Built Form and Heritage Analysis Plan

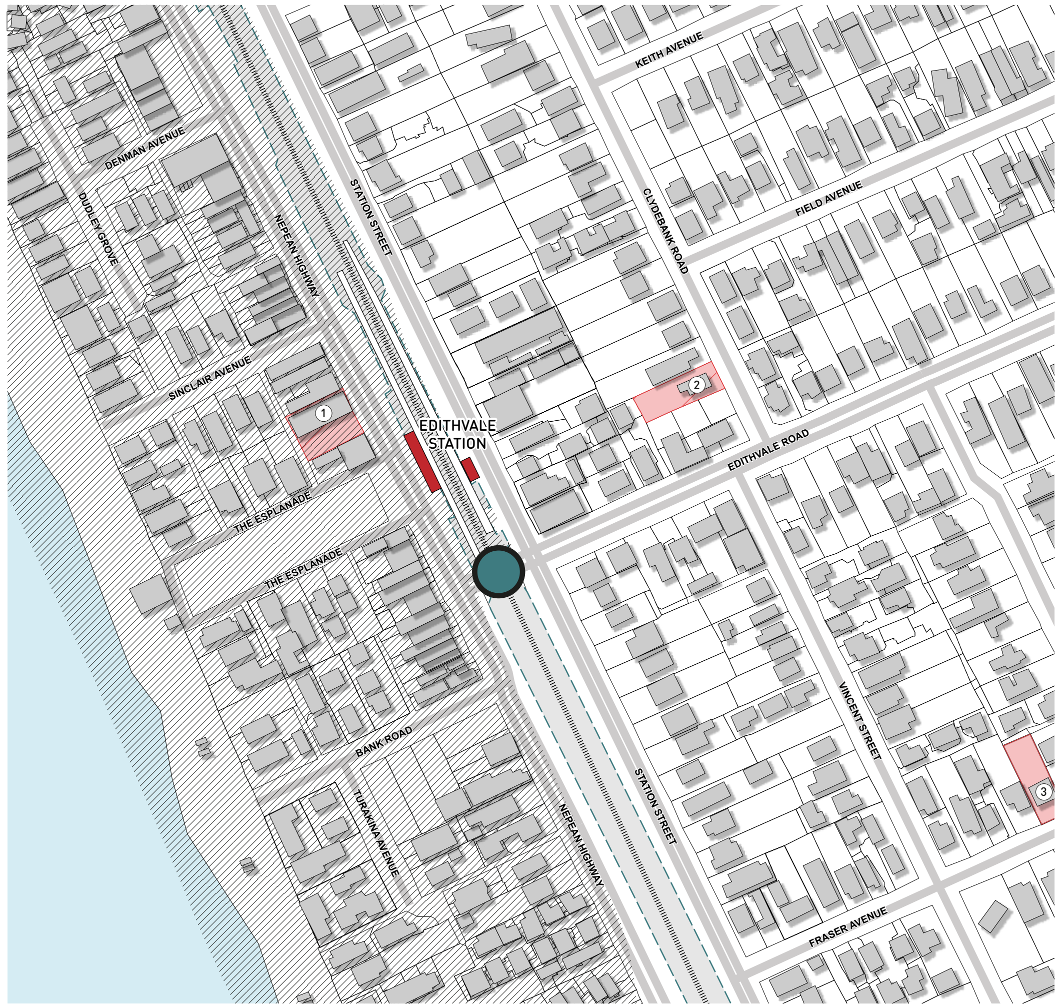


LEGEND

- ● Level Crossing Removal Site
- Railway & Station
- Victrack Boundary
- Major Roads
- Waterbodies
- Conservation Reserves
- Local Activity Centre
- Heritage Listed Sites
- ▨ Area of Cultural Heritage Sensitivity

0 40 80 160 240m
SCALE 1:8,000 AT A3

Figure 10 - Built Form and Heritage Analysis Enlargement



LEGEND

- ● Level Crossing Removal Site
- Railway & Station
- Platform
- Low Scale Built Form (1-2 storeys)

SPECIFIC LAND USES

① Former Edithvale Cinema
② House
③ The Pines

0 20 40 90 120m
SCALE 1:4,000 AT A3

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TRANSPORT NETWORK AND ACCESS

STATION ACCESS

Edithvale Station operates as a Local Station (unstaffed) on the Frankston railway line and connects to Melbourne CBD and other employment and education precincts, including Caulfield and Frankston. Services run at approximately 4-16 minute intervals during the AM peak period and at approximately 5-22 minute intervals during the PM peak. Travel time from Edithvale to the CBD is approximately 50 minutes.

PTV's Station Access Plan for Edithvale Station states that on an average weekday patronage of the station is 1,364 passengers (2012). Of these passengers 60.9% walk to the station, 24.5% travel by car, 11.8% by bus and 2.7% by bicycle.

BUS MOVEMENTS

Edithvale Station has three connecting bus services located to the east of the station precinct on Station Street and Edithvale Road, being routes 902 SmartBus, 858 and 706 (off peak).

VicRoads designates Edithvale Road and Station Street (south of Edithvale Road) as a bus priority route.

VEHICULAR MOVEMENTS AND PARKING

Edithvale Road is an arterial road with a single traffic lane running in each direction. It connects Nepean Highway, a major arterial road and primary route to central Melbourne, with Springvale Road and the Frankston Freeway. Station Street, which runs along the east of the rail corridor, provides a localised connection for cars, buses and cyclists with a similar arrangement from Mordialloc to Carrum. VicRoads is the responsible authority for both Edithvale Road and Nepean Highway.

The station currently accommodates 34 commuter car spaces to the east of the rail reserve. There are more informal car park spaces on the east and west side of the rail reserve on surrounding roads and streets. Car parking for the Neighbourhood Centre is on-road along Nepean Highway.

ACTIVE TRANSPORT

VicRoads' Principal Bicycle Network (PBN) is designated along Station Street and Edithvale Road. Nepean Highway is used by cyclists even though there are no dedicated bicycle lanes.

Currently there is no dedicated Shared Use Path located within the rail corridor. Station Street and Edithvale Road both have painted on-road cycling/parking lanes but no other dedicated cycling space is provided along Nepean Highway.

The rail corridor is bisected by a series of pedestrian crossings. These are located at Denman Avenue, Berry Avenue, Fraser Avenue, and Lochiel Avenue. These crossings are at grade with the railway line and are predominately aligned with existing beach access points.

There are existing signalised pedestrian crossings associated with the Edithvale Road, Nepean Highway and Station Street intersections on the north side only. A crossing is also located south of Denman Avenue across Nepean Highway.

VicRoads designates Nepean Highway, between Derrybeg Lane and Natal Avenue as a pedestrian priority route.

Services run at approximately 4-16 minute intervals during the AM peak period and at approximately 5-22 minute intervals

Image 12: Edithvale Road, Edithvale Level Crossing

Image 13: Station Parking along Rail Corridor

Image 14: Edithvale Station Nepean Highway Access

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Figure 11 - Transport Networks and Access Analysis Plan

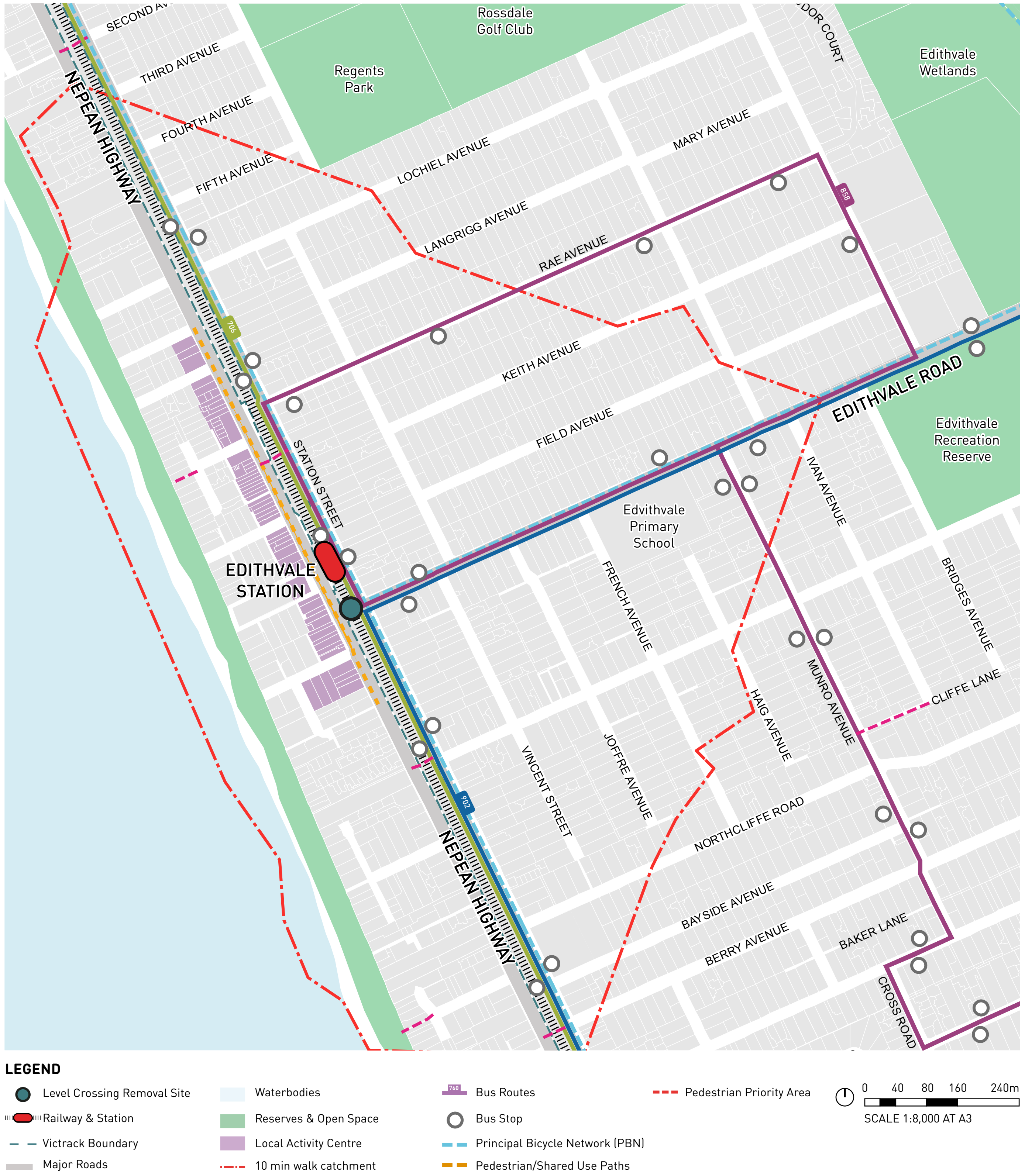
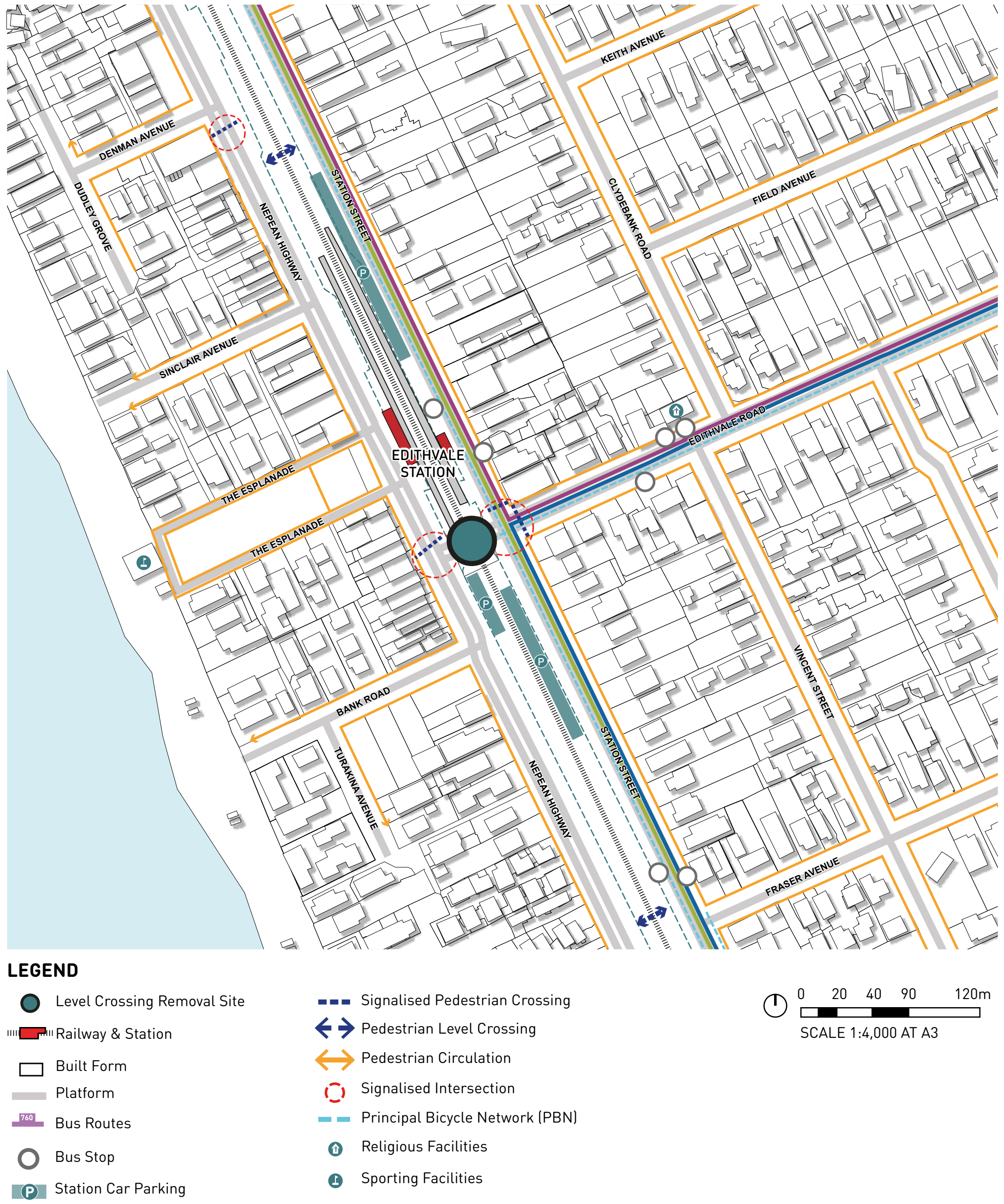


Figure 12 - Transport Networks and Access Analysis Enlargement



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LANDSCAPE AND PUBLIC REALM

GEOMORPHOLOGY

The geomorphology along the railway line at Edithvale Road features Coastal Dune Deposits consisting of sand and silt. Dune blowouts are eroding a series of low unconsolidated ridges along the coast, remnant of a large barrier wetland complex. Drainage schemes and residential development have greatly modified the wetland and barrier terrain. This is the second largest barrier system in Victoria and is an important area for studies of dune, barrier and bar morphology and evolution.

TOPOGRAPHY

The topography is generally flat within the local area and along the rail corridor, which is characteristic of the coastal character of the area. Edithvale Station sits 7m above sea level. The area gradually slopes down to the east and west of the rail corridor to Port Philip Bay.

LANDSCAPE CHARACTER

The project would have direct and permanent interactions with the low-lying coastal landscape, potentially emphasising the existing line of separation between the beach side western area and the main eastern area of Edithvale. Vegetation entails a significant landscape value for the project area in that it reflects the broader low, endemic coastal landscape character associated with the Frankston rail line.

For a more detailed analysis of the landscape character of the site, refer to the Landscape and Visual Impact Assessment prepared as part of the EES.

OPEN SPACE NETWORK

Existing local public space is limited to Beeson Reserve, which provides for passive recreation, and Edithvale Recreation Reserve and Regents Reserve, which are located further from the site and cater for a range of sporting uses. Beeson Reserve is an important gateway between the station and beach, highlighted through formal planting, with fringing vegetation and low scattered trees on the boundary adjacent to The Esplanade.

Public space within the Edithvale Neighbourhood Centre is limited to footpaths outside retail/commercial businesses. However, Edithvale Beach and Foreshore/Port Philip Bay Foreshore provides a popular destination for passive recreation for the local community and broader public.

There is no station forecourt at Edithvale Station and there is limited circulation space around the station entry. Some landscaping is located along Nepean Highway.

NATURAL ENVIRONMENT

The streetscapes of the local area are sparsely landscaped with canopy tree vegetation. The rail corridor contains a moderate to low intermittent cover of endemic low-growing regrowth shrubs and trees, the height of which is likely to be limited by regular exposure to salt laden winds from Port Phillip Bay. Intermittent planting along the rail corridor screens views from adjacent residential and retail/commercial areas.

Surrounding recreational parks and reserves, and the Edithvale-Seaford Wetlands contribute to the green landscape character of the area.

The Edithvale-Seaford Wetlands are located to the east of the rail corridor. Listed as a Wetland of International Importance under the Ramsar Convention, it is recognised as an important natural habitat for a range of flora and fauna species. This includes over 190 bird species and 14 plant communities, with many of these being of State and regional significance.

Plains Grassy Wetland ecosystems provide open-grassland/herbland of up to 1m in height along the rail corridor to the north and south.

Coastal Dune Scrub, listed as vulnerable, predominates along the foreshore of Edithvale Beach. This indicates deep, uniform textured siliceous and calcareous sands subject to high levels of saltspray, wave action and disturbance from onshore winds, with a structure that is comprised of scrub up to 5 metres in height. Coast Banksia Woodland can be found throughout Edithvale Wetlands and the Rossdale Golf Club.

Image 15: Edithvale-Seaford Wetlands

Image 16: Edithvale Beach

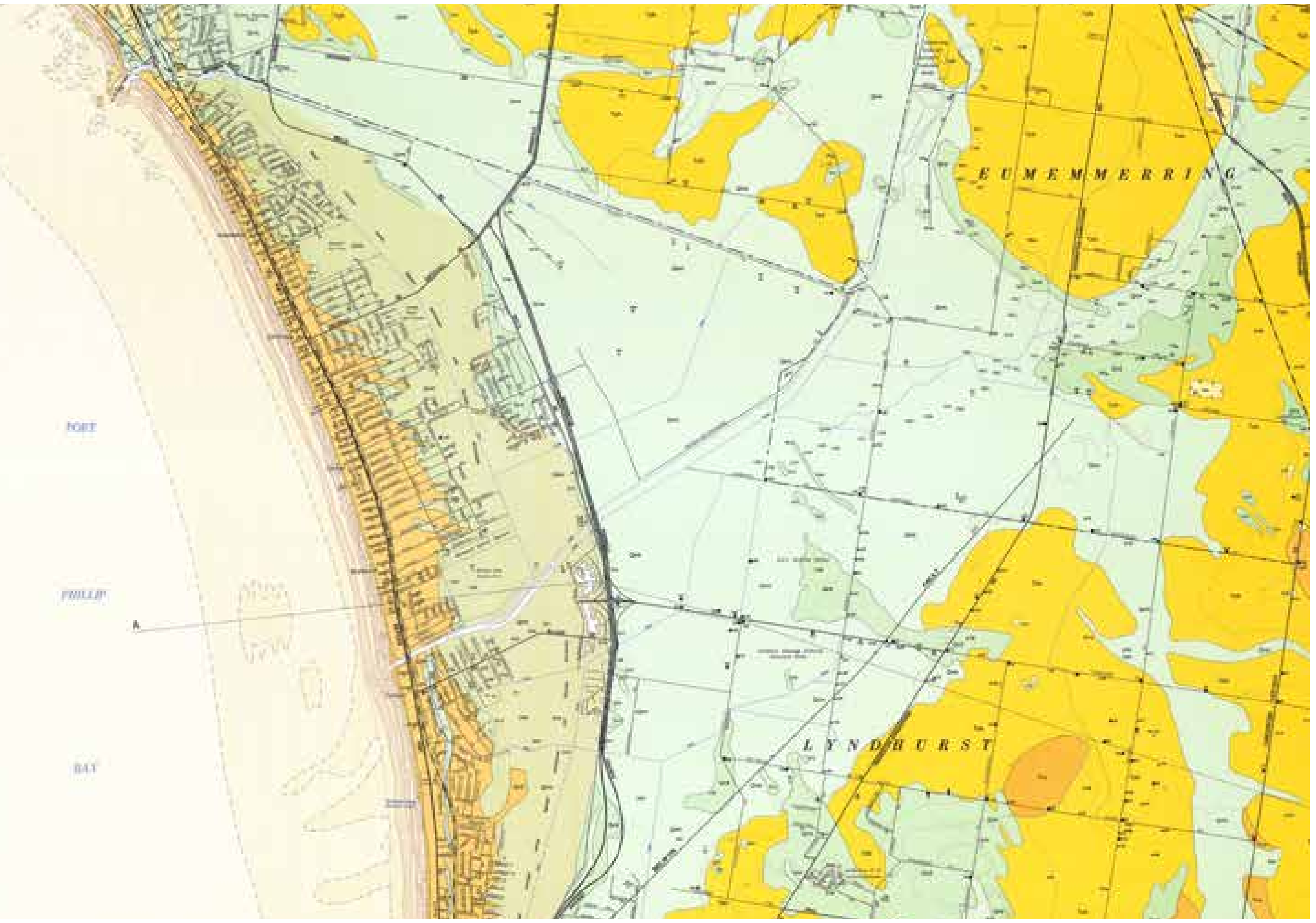

Figure 13 - Geomorphological Map of Area

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Figure 14 - Transport Networks and Access Analysis Plan

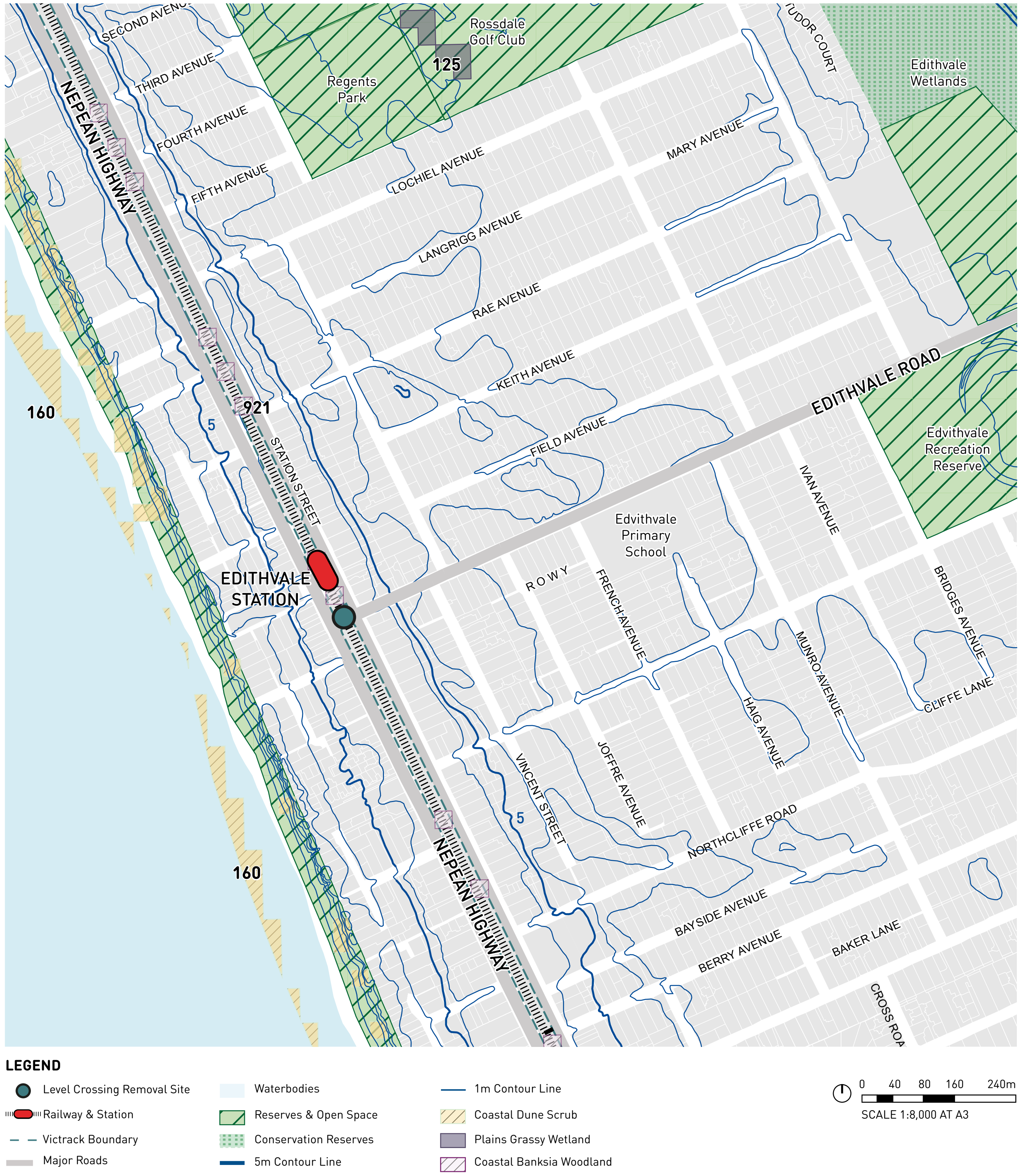
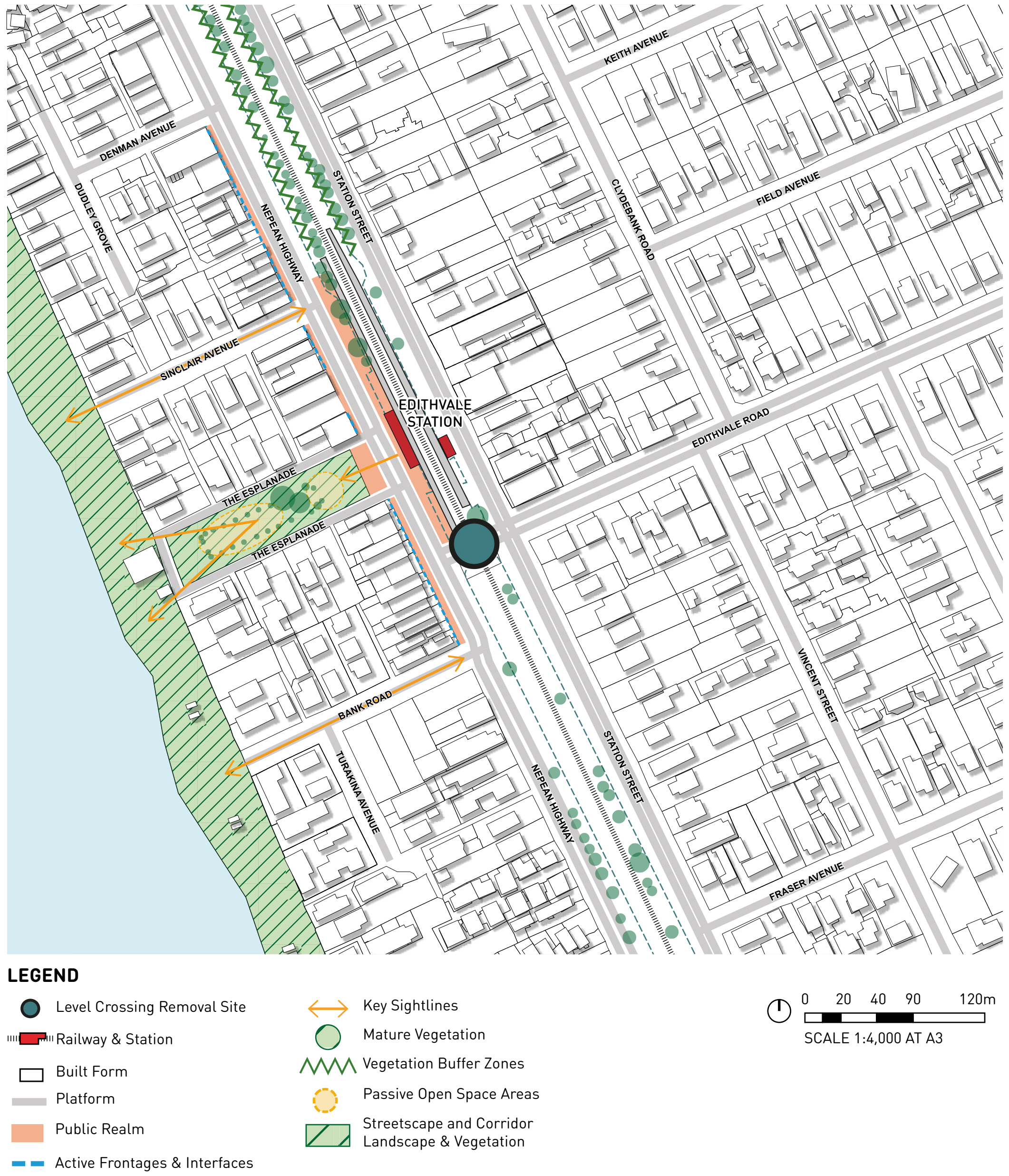


Figure 15 - Transport Networks and Access Analysis Plan



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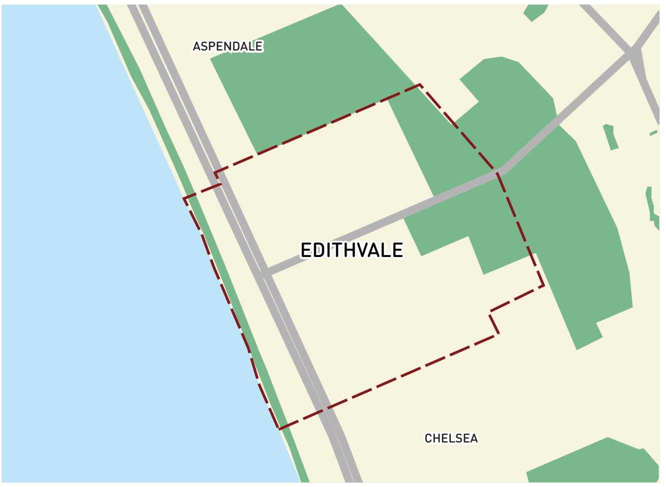
2.4 DEMOGRAPHICS

Figure 16 - Key Map - Edithvale Statistical Area



The following infographics represent a summary of the demographic characteristics for the Edithvale Statistical Area (SSC20446). The data has been derived from the 2011 and 2016 Australian Bureau of Statistics, Quick Stats and future population forecast data from the City of Kingston Profile id.

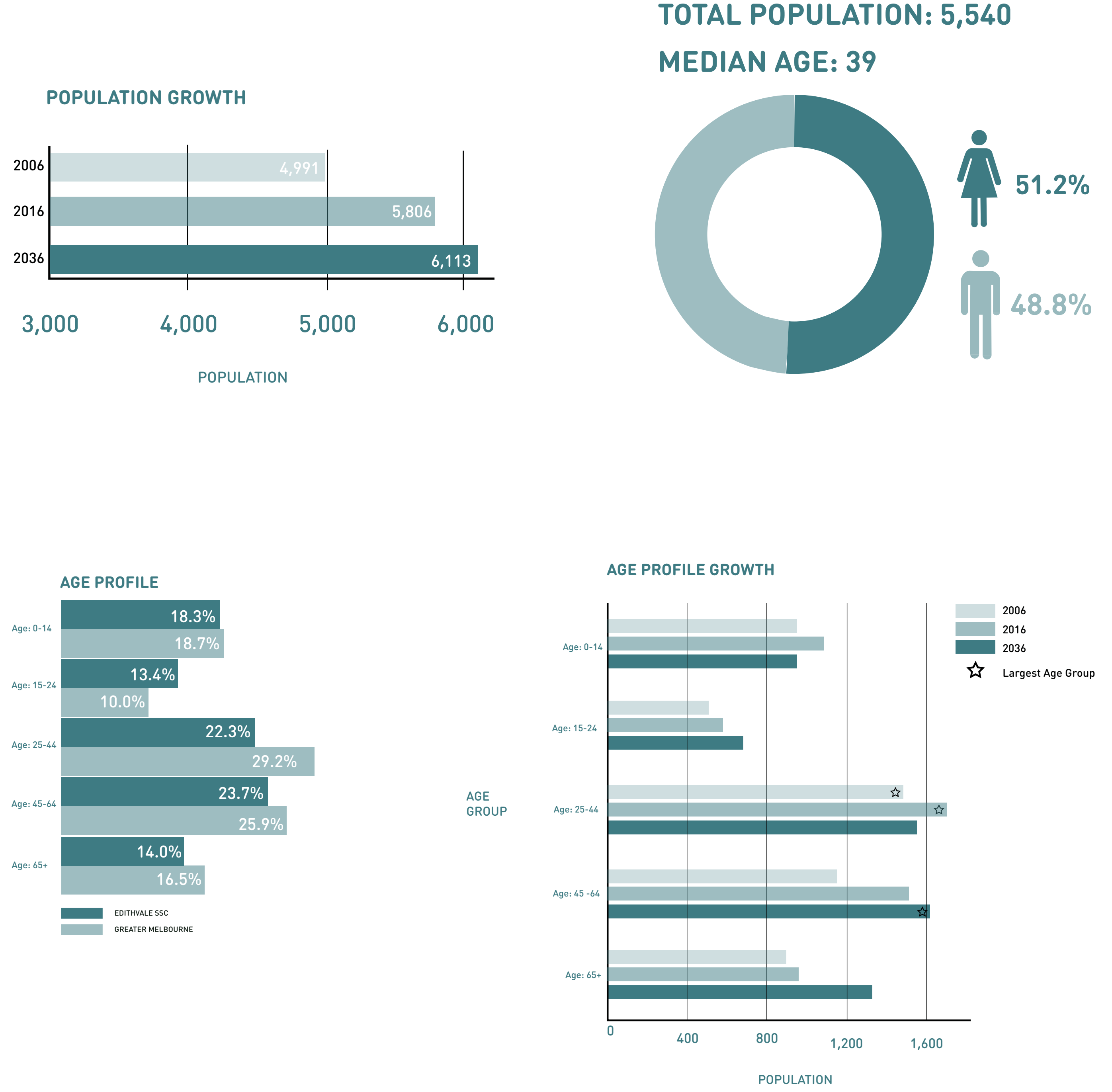
POPULATION PROFILE

At the time of the 2016 Census, Edithvale had a population of 5,806 people. The area has undergone a consistent increase in population from 2006 to 2016. While continuous growth is expected up to and past 2036, the rate of growth is predicted to slow.

In 2016 the population had a relatively even proportion of males (48.8%) and females (51.2%). The median age was 39, corresponding with the largest age group of 25 - 44 year olds. In comparison to Greater Melbourne, Edithvale has a very similar proportion of persons aged between 0 - 14 years. There is a slightly higher proportion of young adults aged between 15 and 24, at 13.4%. However, other age groups are than Greater Melbourne, suggesting that Edithvale has a slightly higher proportion of young individuals than is seen throughout Melbourne.

Between 2006 and 2016 the two age cohorts that increased were aged 0 - 14 and 25 - 44 years old. However, both groups are predicted to represent a lower proportion of the future population estimates in 2036. All other age groups are lower than the average proportion through Greater Melbourne, with a significant increase in population above 65 years old from 2016 to 2036.

Figure 17 - Population Profile and Growth Projections



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DWELLING CHARACTERISTICS

A high percentage of private dwellings within the Edithvale Statistical Area are occupied (91.7%). The number of dwellings has increased by 372 from 2006 to 2016. While dwelling growth is predicted to increase by 2036, the rate will slow with only 168 new dwellings over the 20 year period.

Of the occupied private dwellings within Edithvale, 54.5% of dwellings were separate houses, 13.7% were semi-detached terrace houses or townhouses, and 31.5% we flats, units or apartments, with 0.3% classified as other dwellings. The area has shown a considerable decrease in the volume of separate houses from 2011 by 15.1% (from 69.6%) and a 13.2% increase in flats, units or apartments (from 18.3%).

In comparison to Greater Melbourne, Edithvale has larger dwelling mix. With approximately 15-25% changes between groups. Within Greater Melbourne the volume of semi-detached terrace or townhouse, and flat, unit, or apartments and much closer at 16.8% and 14.7% respectively.

Figure 18 - Dwelling Profile and Growth Projections

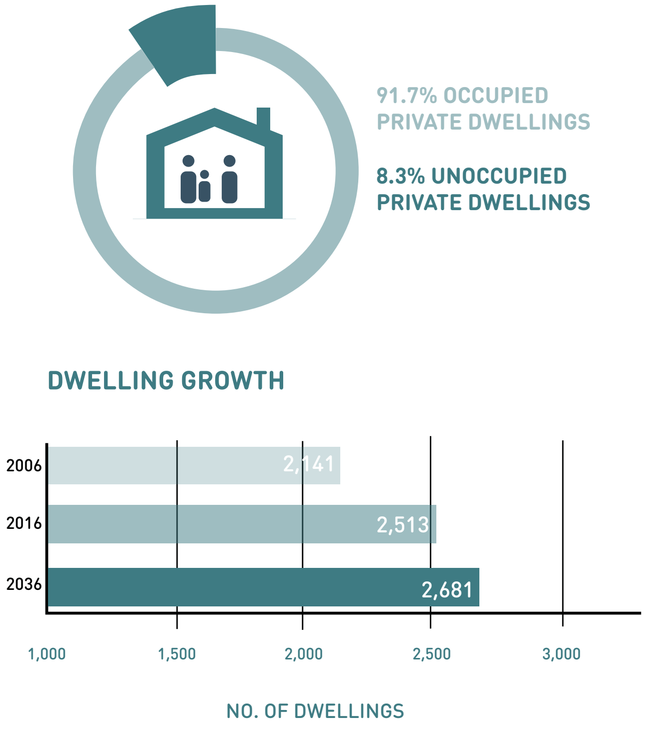
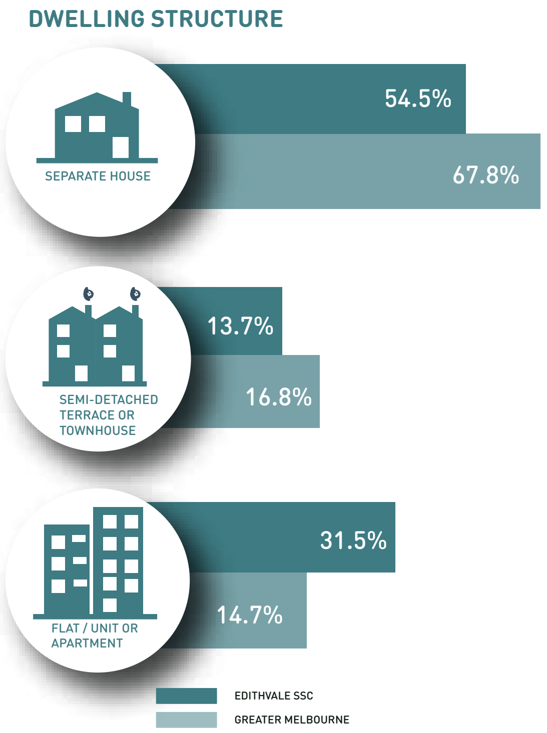


Figure 19 - Dwelling Profile Comparative Analysis

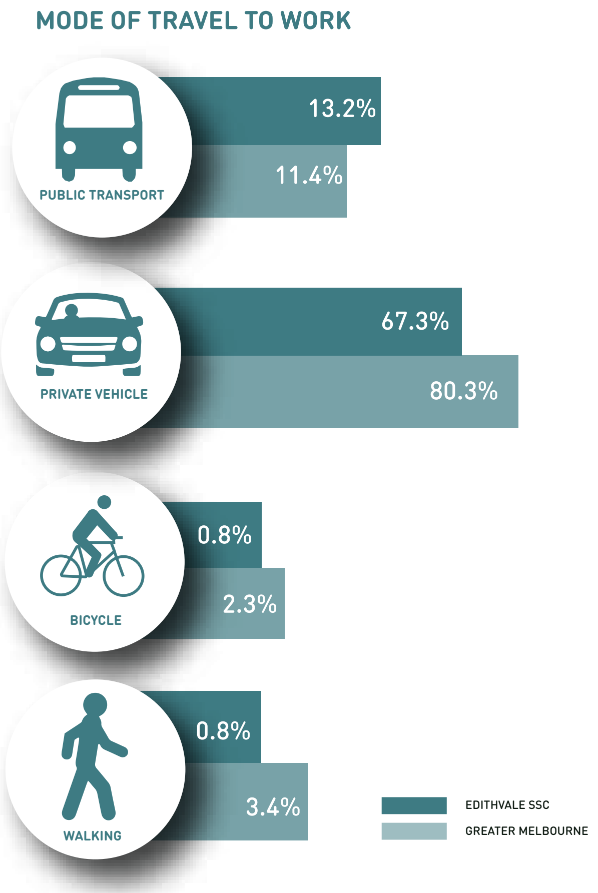


MODE OF TRAVEL

Of the population within Edithvale, 67.3% of people on an average weekday drive to work. Of these, 3.8% are passengers suggesting that the majority of vehicles are solo-occupied. A further 13.2% travel by public transport, including train, bus, and taxis, while only 0.8% cycled, and 0.8% walked as their only mode of travel.

In comparison to Greater Melbourne, a larger proportion of people catch public transport to work. While slightly smaller proportions drive, it is still significantly the largest mode of transport. Less people use active modes of travel with below 1% cycling or walking in Edithvale, while percentages are 2 to 3 times higher in Greater Melboune.

Figure 20 - Modal Share Comparative Analysis



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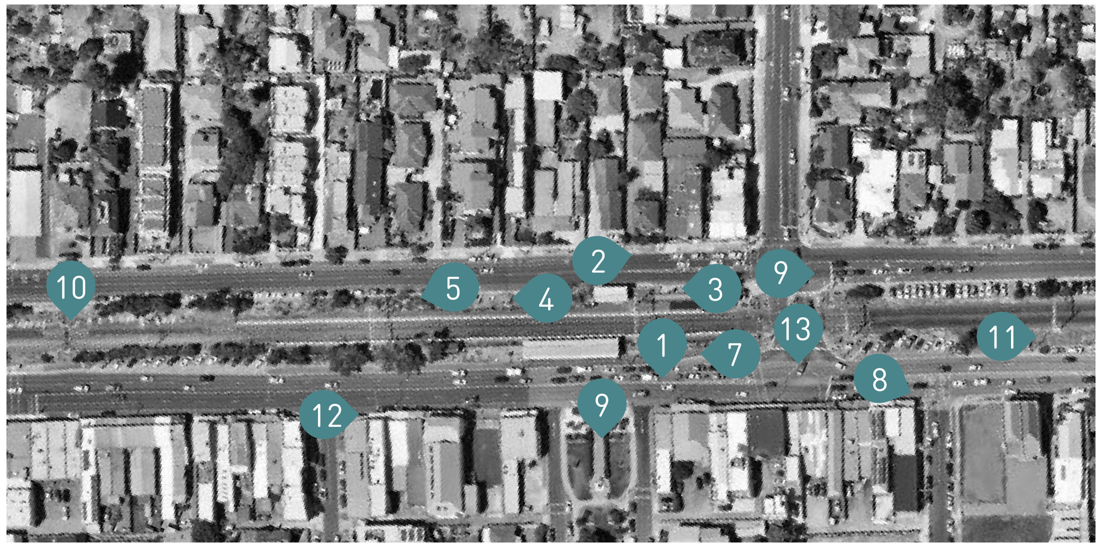
2.5 PHOTOGRAPHIC SURVEY

Figure 21 - Key Map - Edithvale Photographic Survey



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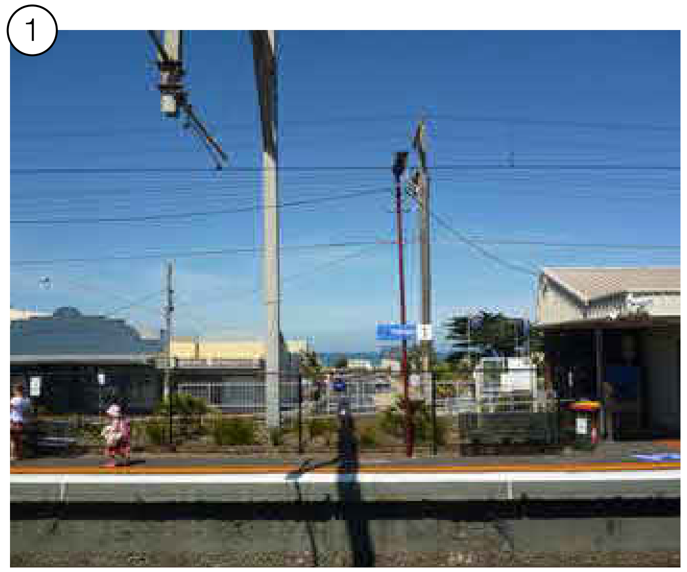
Image 17: Edithvale Station Platform

2

Image 18: Southbound Station Street Bus Stop Opposite Edithvale Station

3

Image 19: Edithvale Station access Station Street

4

Image 20: Northbound Station Street Bus Stop

5

Image 21: Station Street Rail Corridor Planting

6

Image 22: Edithvale Road, Edithvale Level Crossing Looking South

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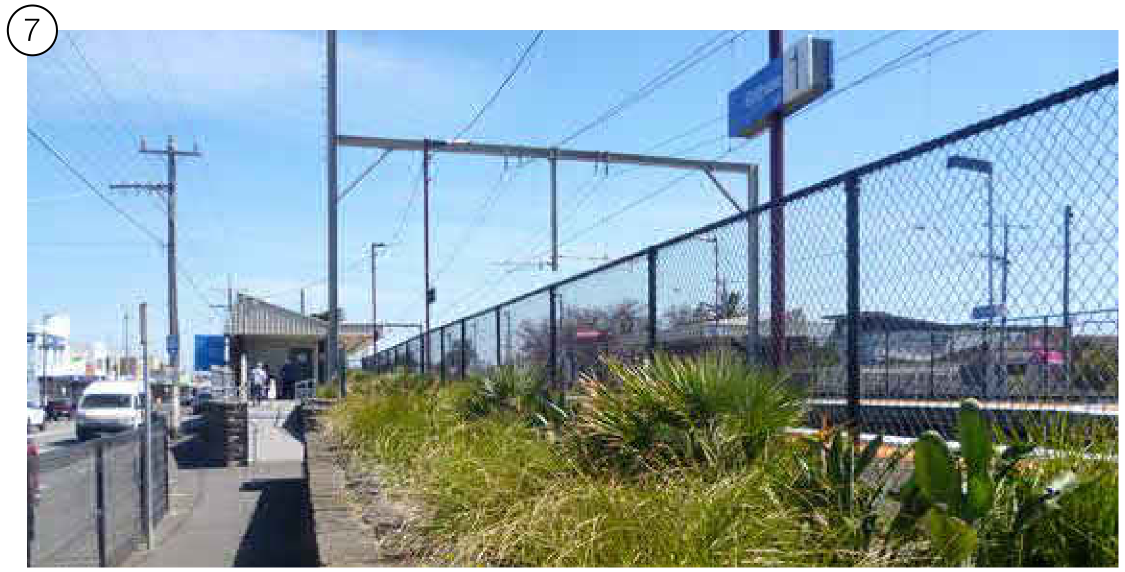

Image 23: Edithvale Station Nepean Highway Access

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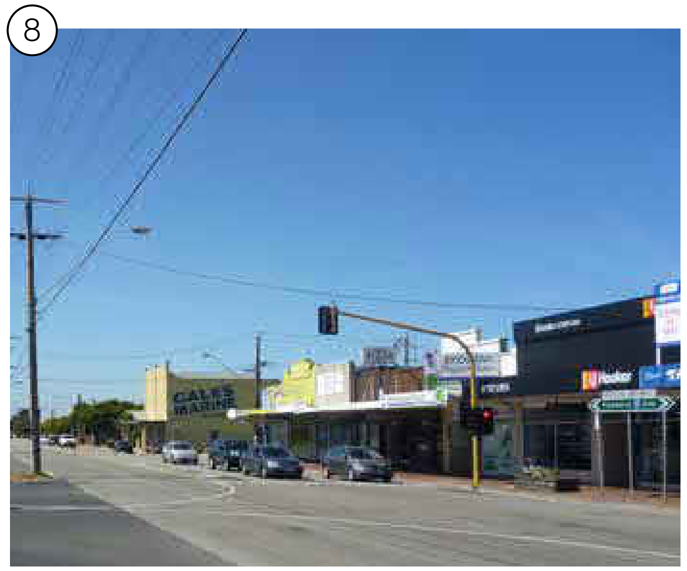

Image 24: Nepean Highway Residential Shopping Strip

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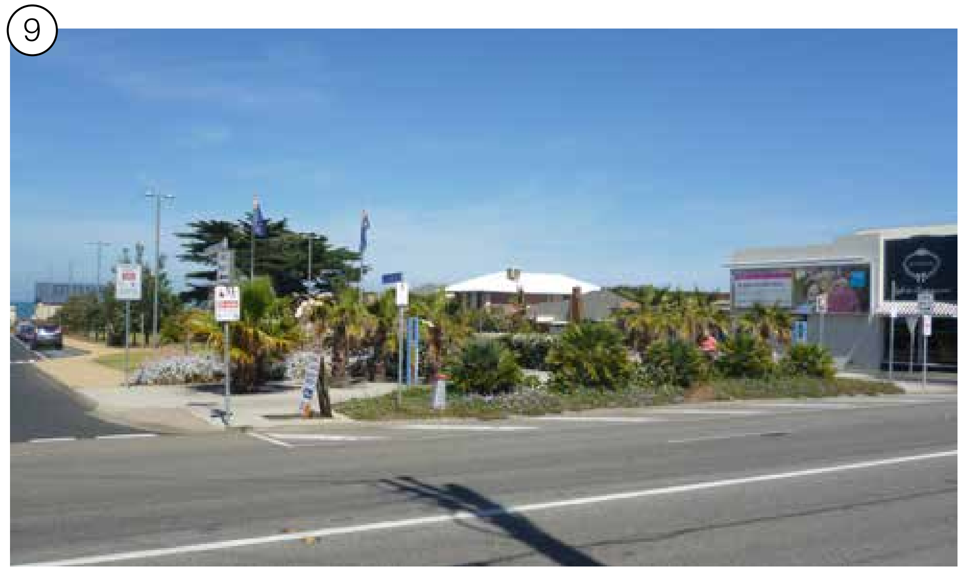

Image 25: Beeson Reserve

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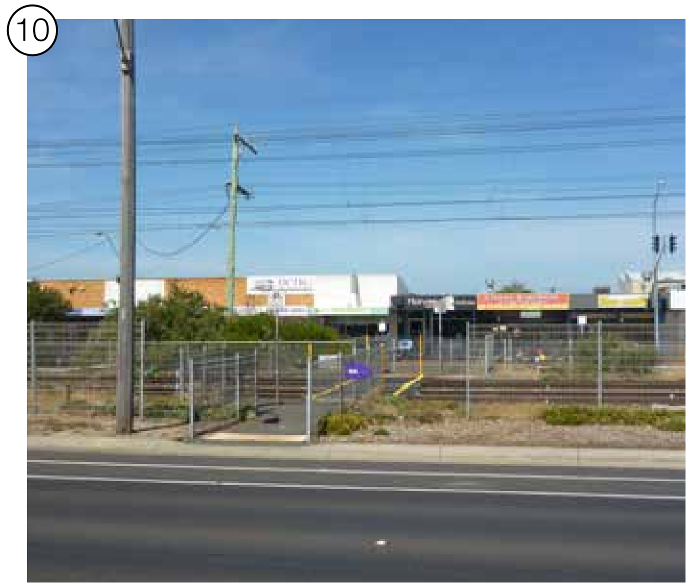

Image 26: Pedestrian Level Crossing at Denman Avenue

11

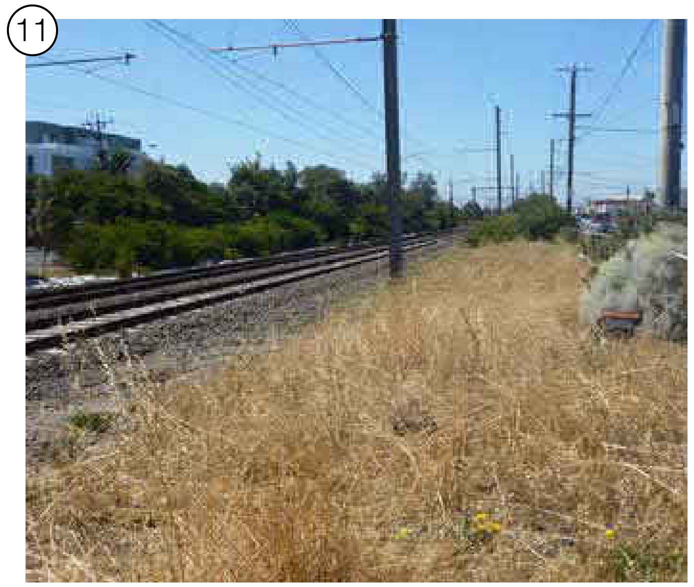

Image 27: Rail Corridor Vegetation South of Edithvale Road

12

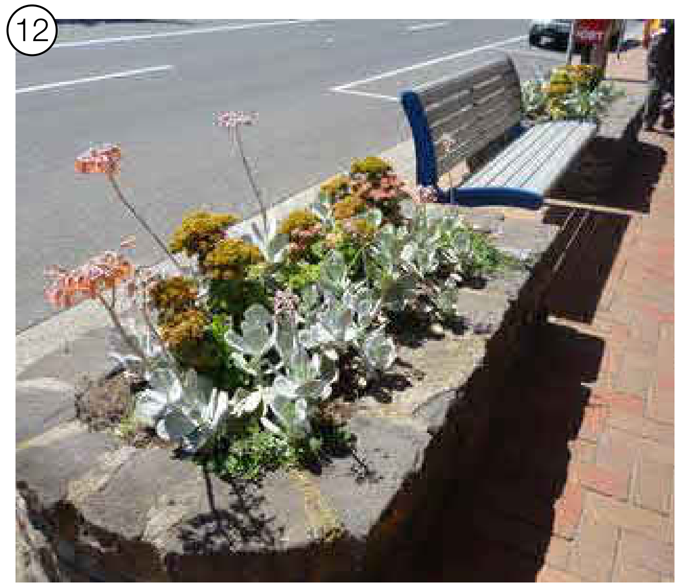

Image 28: Street Planters along Nepean Highway

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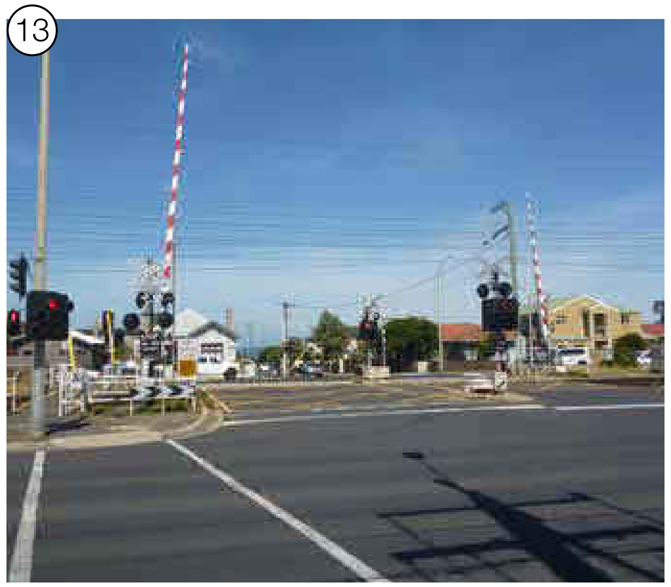

Image 29: Edithvale Road, Edithvale Level Crossing Looking West

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3.0 STRATEGIC PLANNING AND POLICY ANALYSIS

3.1 STATE PLANNING POLICY
3.2 LOCAL PLANNING POLICY
3.3 OTHER STRATEGIES
3.4 RELEVANT PROJECTS

3. STRATEGIC PLANNING AND POLICY ANALYSIS

3.1 STATE PLANNING POLICY

PLAN MELBOURNE

Plan Melbourne 2017-2050 sets out the Victorian Government's strategy to manage the long term growth of metropolitan Melbourne and its population. The strategy identifies the infrastructure, services and major projects that are required to support growth, including the level crossing removal project.

Plan Melbourne recognises that the level crossing removal project will improve the efficiency and safety of the arterial road network across Melbourne and will better connect people to job opportunities in key areas, particularly in Melbourne's west and south-east. It is also identified that the project will create opportunities for urban renewal and development.

The Edithvale Road, Edithvale level crossing is located within Melbourne's Southern Subregion, as identified in Map 13 of Plan Melbourne. The Southern Subregion contains some of Melbourne's most important activity, economic and employment centres, including the Frankston and Dandenong Metropolitan Activity Centres, the Dandenong National Employment and Innovation Cluster. Chelsea is located to the south of the level crossing and is identified as a Major Activity Centre.

The population within the Southern Subregion is expected to increase from 1,140,000 people in 2014 to approximately 1,540,000 in 2031.

SOUTH EAST GROWTH CORRIDOR PLAN

The South East Grown Corridor is identified as a substantial economic region in Melbourne that will eventually accommodate a population of 230,000 or more people and has the capacity to provide for at least 86,000 jobs. The South East Growth Corridor Plan recognises the need to enable improved access to important activity and employment areas within the region and to central Melbourne by improving arterial road and public transport connections.

The level crossing removal at Edithvale Road, Edithvale will support the South East Growth Corridor Plan by improving the road, public transport and freight network.

STATE PLANNING POLICY FRAMEWORK

The State Planning Policy Framework (SPPF) contained at Clause 9 to Clause 19 of all Victorian Planning Schemes seek to ensure that land use and development policies in Victoria meet the objectives of planning in Victoria as set out in the Planning and Environment Act 1987. The SPPF provides direction on matters to be considered in all planning decisions and seeks to ensure that the needs of existing and future communities are properly planned having regard to a range of factors

The Clauses which are considered to be relevant to the level crossing removal at Edithvale Road, Edithvale include Clause 9 (Plan Melbourne), Clause 11 (Settlement), Clause 11.06 (Metropolitan Melbourne), Clause 15 (Built Environment and Heritage), Clause 17 (Economic Development) and Clause 18 (Transport).

3.2 LOCAL PLANNING POLICY

KINGSTON PLANNING SCHEME

The policies and controls contained in the Kingston Planning Scheme apply to the Edithvale Road, Edithvale level crossing removal.

Clause 21.02 – Location

Clause 21.02 recognises that Kingston is one of the most diverse municipalities in Melbourne that combines substantial residential areas with activity centres, agricultural and non-urban uses, as well as an industrial sector which forms one of the largest and most concentrated manufacturing regions in Melbourne. Transport corridors in Kingston, including the Frankston railway line and important north-south and east-west arterial routes are recognised as important connections to the regions industrial and commercial areas to local, interstate and international markets.

Clause 21.03 – Land Use Challenges for the New Millennium

Clause 21.03 recognises key land use issues which Council has identified which are likely to challenge the future growth and development within Kingston, including protecting and enhancing ecological values. It is also identified that Council will continue to advocate for improvements to the primary arterial network and the construction of missing links in the regional network to assist in reducing the impact of heavy traffic on the local road network.

Clause 21.04-2 – Key Land Use Themes

Clause 21.04 recognises that Kingston's vision for future land use planning and development is expressed around a number of key land use themes, including retail and commercial land use, environment, wetlands and waterways, transport, movement and access and heritage.

The area around the Edithvale Neighbourhood Activity Centre is identified in the Strategic Land Use Framework Plan as being an area suitable for promoting increased housing diversity.

Clause 21.06 – Retail and Commercial Land Use

Clause 21.06 seeks to protect and strengthen the hierarchy of activity centres and their different built form character and function by creating opportunities to strengthen the role of public transport, walking and cycling as a means of accessing centres. The Retail and Commercial Land Use Framework Plan recognises Edithvale as a Neighbourhood Activity Centre. The primary role of such centres is for local, convenience shopping and a mix of retail and service facilities. This is to be achieved by promoting a mix of commercial, retail, residential and community facilities to enhance their function as local community centres. Clause 21.06-3 seeks to improve accessibility to and within all activity centres through adequate transport infrastructure and services, pedestrian movement networks and connectivity of residential areas and centres with key public transport nodes through public and private infrastructure investment particularly through significant development proposals.

Clause 21.08 – Foreshore

Clause 21.08 establishes Council's commitment to the ongoing protection of the social, ecological and environmental values of the Kingston foreshore. A key strategy identified by the policy is to provide fair and equitable access to coastal areas by encouraging a range of transport and access options, such as public transport, cycling and walking. This may be supported by pedestrian and cycling trails along the coast and to inland areas including public transport nodes.

Clause 21.09 Environment Wetlands and Waterways

Clause 21.09 acknowledges that the environmental landscape of the City of Kingston is recognised for its diversity and significance in both a local and regional context. It specifically recognises the role of the Edithvale-Seaford wetlands as an internationally significant wetland area and seeks to protect the physical and habitat diversity of the wetlands and maintain the diversity of flora and fauna habitats within Kingston.

Clause 21.12 – Transport, Movement and Access

Clause 21.12 seeks to create a safe, convenient and efficient road network which meets the transport and freight needs of Kingston's residents, businesses, and through traffic. In addition, it aims to integrate public transport, road, pedestrian and cycle systems with activity centres and social and community infrastructure, as a means of providing equitable and safe vehicular, pedestrian and cyclist movement and access for the community.

It recognises the existing road capacity issues causing conflicts between high traffic volumes, activity centres and residential areas in the City of Kingston. Strategies to address this include the establishment of a functional hierarchy of local and regional road networks to improve efficiency and safety; the integration of public transport, road, pedestrian and cycle networks with activity centres, schools, and community facilities to provide equitable access for the community; and the protection and enhancement of amenity of sensitive areas through the appropriate management of transport networks.

Clause 21.13 – Heritage Policy

Clause 21.16 seeks to identify, protect, conserve and manage places or elements of cultural heritage significance within the City of Kingston.

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ZONING AND OVERLAYS

Planning Zones

A number of zones affect the area surrounding the project. These are identified below and the relevant zoning map is shown in Appendix C.

The Edithvale Railway Station and the railway corridor are affected by the Public Use Zone 4 – Transport (PUZ4). The application of this zone recognises the use of this land for transport purposes.

The Nepean Highway and Edithvale Road are affected by the Road Zone Category 1 (RDZ1). The zone identifies significant existing roads or land that has been acquired for a significant proposed road. Road reservation affected by this zone is managed by VicRoads, who are also the referral authority under the zone.

The land to the north-east and south-east of the level crossing removal site is located within the General Residential Zone – Schedule 2 (GRZ2). The GRZ2 provides for moderate housing growth up to a maximum of 11 metres, as well as educational, recreational, religious, community and a limited range of other non-residential uses to serve local community needs in appropriate locations.

The land to the and south-west and north-west of the level crossing removal site, between Port Phillip and the Frankston rail corridor, is located within the Commercial 1 Zone (C1Z) and the GRZ2 zone. The C1Z seeks to create vibrant mixed use commercial centres for retail, office, business, entertainment and community uses by providing for a variety of retail, office, business, entertainment, education and community uses. Residential uses at densities complementary to the role and scale of the commercial centre are also encouraged.

A number of zones affect the land beyond the immediate surrounds of the level crossing removal site, including: General Residential Zone – Schedule 3 (GRZ3), Mixed Use Zone (MUZ), Public Park and Recreation Zone (PPRZ), Public Use Zone – Service & Utility (PUZ1), Public Use Zone – Education (PUZ2) and Special Use Zone (SUZ1).

A detailed analysis of the land use zones can be found in the Land Use report prepared as part of the EES.

Planning Overlays

A number of overlays affect the area surrounding the project. These are identified below.

Design and Development Overlay - Schedule 1 (DDO1) and Design and Development Overlay – Schedule 7 (DDO7) applies to land immediately north-west and south-west of the level crossing removal site, between Port Phillip and the Frankston rail corridor. DDO1 seeks to protect and enhance the visual and aesthetic appearance of the Port Phillip foreshore area by ensuring that building heights, bulk and setbacks are compatible with surrounding buildings and natural features, and are sympathetic to the surrounding natural landscape and environment. In addition to these objectives, DDO7 seeks to ensure that new buildings and works are appropriately setback from the Port Phillip foreshore reserve boundary.

Heritage Overlay 48 (HO48) affects land immediately north-east of the level crossing removal site. HO48 recognises the Former Edithvale Cinema located at 254-258 Nepean Highway as the place of heritage significance. The HO seeks to conserve and enhance heritage places and elements which contribute to the heritage significance of places and to ensure that development does not adversely affect the significance of heritage places.

A number of overlays affect the land beyond the land in the immediate surrounds of the level crossing removal site, including: Environmental Audit Overlay (EAO), Environmental Significance Overlay (ESO), Land Subject to Inundation Overlay (LSIO) and Special Building Overlay (SBO).

3.3 OTHER STRATEGIES

SMARTROADS (VICROADS)

SmartRoads is a policy designed to manage the increasing number of trips taken on roads in Victoria. It aims to address the competing interests for limited road space by giving priority to certain transport modes at particular times of the day. SmartRoads recognises the increasing importance of public transport, walking and cycling as transport modes, and has therefore established a set of guiding principles for the priority use of roads by transport mode, time of day, and place of activity. This ensures that decisions about the operation of the road network support integrated land use and transport planning. Edithvale Road and Nepean Highway is identified within the policy as an existing arterial traffic route.

PRINCIPAL BICYCLE NETWORK (VICROADS)

The Principal Bicycle Network (PBN) is a network of existing and proposed bicycle routes identified to help people ride to major destinations around metropolitan Melbourne. First developed in 1994, it was recently reviewed to focus more on getting people into activity centres and to make more use of local roads and off-road paths. The current plan was released in 2012. Edithvale Road, Nepean Highway and the Edithvale-Seaford Wetlands shared use trail is identified within the policy as part of the PBN.

NETWORK DEVELOPMENT PLAN (PTV)

The Network Development Plan is a strategy to address the rapid growth in train patronage across Melbourne's metropolitan network forecast for the next 20 years and beyond. Key strategies of the plan include expanding the capacity of the existing network; the redesign of train services to maximise opportunities for the seamless coordination with buses and trains; and to extend the network into new growth areas. The strategy includes the introduction of a metro-style train system for Melbourne to provide more high capacity and high frequency services.

FRANKSTON CORRIDOR URBAN DESIGN STRATEGY

An Urban Design Strategy for the Frankston railway line corridor is currently being prepared by the LXRA. The purpose of the strategy is to identify the urban design opportunities for all level crossing projects undertaken along the Frankston Railway Line by the LXRA and ensure a coordinated approach to the design of the level crossing removal projects.

The Strategy Identifies a number of potential actions across State government departments, authorities, agencies and local government that impact upon or should be considered in the planning and implementation of level crossing removals.

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4.0 COMMUNITY AND STAKEHOLDER ENGAGEMENT

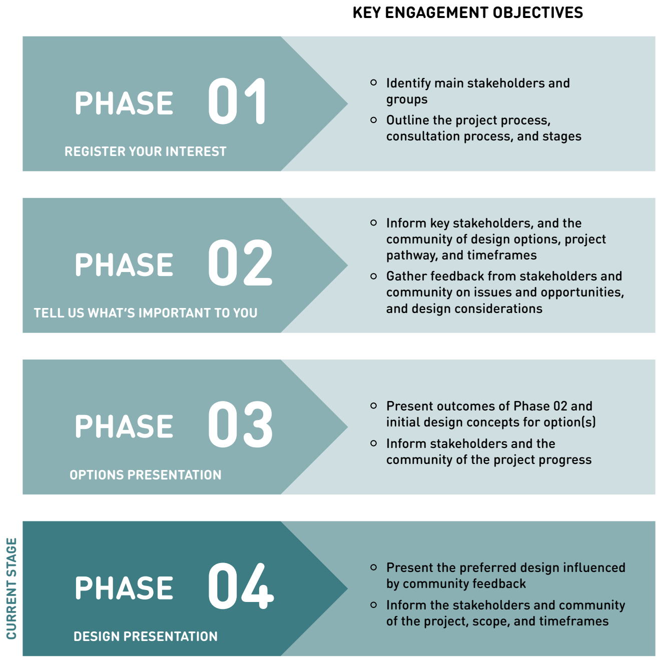
4.1 OVERVIEW
4.2 STAKEHOLDER ENGAGEMENT
4.3 COMMUNITY CONSULTATION

4. COMMUNITY AND STAKEHOLDER ENGAGEMENT

4.1 OVERVIEW

Community and stakeholder engagement plays an important role in developing and shaping the Edithvale level crossing removal project. The LXRA has undertaken an extensive engagement program to ensure the Edithvale community and stakeholders are informed, involved and are able to actively contribute to the development of the level crossing removal project (refer to Figure 22).

Figure 22 - Engagement Phases



KEY ENGAGEMENT OBJECTIVES

PHASE 01 REGISTER YOUR INTEREST
- Identify main stakeholders and groups
- Outline the project process, consultation process, and stages

PHASE 02 TELL US WHAT'S IMPORTANT TO YOU
- Inform key stakeholders, and the community of design options, project pathway, and timeframes
- Gather feedback from stakeholders and community on issues and opportunities, and design considerations

PHASE 03 OPTIONS PRESENTATION
- Present outcomes of Phase 02 and initial design concepts for option(s)
- Inform stakeholders and the community of the project progress

CURRENT STAGE

PHASE 04 DESIGN PRESENTATION
- Present the preferred design influenced by community feedback
- Inform the stakeholders and community of the project, scope, and timeframes

4.2 STAKEHOLDER ENGAGEMENT

KINGSTON CITY COUNCIL

Kingston City Council was directly engaged by the LXRA consultation program in meetings, briefings, attendance at information sessions and representation on the Technical Reference Group (TRG). The TRG was formed for the purposes of the EES.

Kingston City Council maintains an interest in supporting and promoting a wider mix of commercial, residential and retail uses in Edithvale Neighbourhood Centre and encourages a consistent built form as the centre develops.

Council have been engaged throughout the development of the station and have been a strong advocate for prioritising and promoting walking and cycling through the provision of safe, attractive and functional infrastructure for active transport users.

METRO TRAINS MELBOURNE AND PUBLIC TRANSPORT VICTORIA

MTM and PTV are responsible for rail infrastructure in metropolitan Melbourne and have developed preliminary patronage forecasts and a range of policies that influence design of the station and the wider station precinct. These include vertical transportation, station layout, car parking provision and service vehicle standards.

Other elements that affect the urban design quality of the project include landscape guidelines, fence and barrier and other safety requirements along the rail corridor developed by MTM. Both MTM and PTV have been actively involved in the development of Edithvale Station and have provided advice throughout its development.

VICROADS

VicRoads is responsible for the management of the metropolitan road network, with specific responsibility for Nepean Highway as an arterial road and any associated road signals. Strict standards exist for road alignment design, maximum gradients, traffic visibility and height clearances.

Standards that strongly influence the urban design opportunities include minimum clearances between the traffic lanes and roadside hazards, traffic barrier requirements, and the separation of intersections and signals along arterial routes. VicRoads has been actively engaged throughout the design process.

OTHER STAKEHOLDERS

Other key stakeholder groups, whose particular interests and needs have been considered in the development of options, include:

- Local residents;
- Local traders;
- Local schools;
- Service Authorities;
- Pacific National (freight rail operator);
- Department of Environment, Land, Water, and Planning (DELWP);
- Victorian Planning Authority (VPA), and
- Office of the Victorian Government Architect (OVGA).

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4.3 COMMUNITY CONSULTATION

CONSULTATION PROCESS

Community members and local traders have been invited throughout the project to review, discuss and share their feedback in relation to the level crossing removals. Four phases of engagement have been undertaken to date.

From February 2016 to June 2016, awareness-raising and feedback gathering activities created opportunities for local communities to learn about the level crossing removal project and to share what is important to them in their local area.

During this period, nine community information sessions were held with 500 community feedback forms, 4,500 pieces of online feedback and over 200 phone/email enquiries received from local residents, community groups and traders.

The initial feedback, alongside the technical investigations, helped LXRA to identify two viable options for the level crossing removals – a rail bridge under Edithvale Road and a rail bridge over Edithvale Road. Community feedback on the two options was sought through the next phase of consultation, which was carried out in September/October 2016.

In November 2016, the recommended rail under road option was presented to the community. Further feedback and local knowledge was also sought to shape the details of the option ahead of the tender process. This included a community workshop to capture local ideas and views about the project, undertaken in September 2017.

In addition to the formal engagement activity, LXRA staff spoke with concerned residents to discuss the project design, solution, answer questions, hear concerns and capture views on the detailed aspects of the projects at Edithvale.

EMERGING THEMES

A number of themes have emerged from the community consultation exercises undertaken to date. These include:

- Importance and value of the landscape character and further enhancement along the rail corridor;
- Desire to balance user needs so that all users and all transport modes are catered for equitably to ensure that the solution benefits a broad cross section of the community, and
- The need for the design and materials to respond to and reflect the valued natural coastal setting and emerging architecture.

Community and stakeholder feedback will be used as part of the EES process. It will also be used during the project's tender and detailed design phase to further shape the project and deliver positive outcomes for the Edithvale community.

More information about this design will be made available to the community once a contractor is brought on board in 2019.

Figure 23 - Community Consultation Snapshot

☑ Community sessions

☒ Station pop ups

☑ Letter drops & newsletters

☑ Council meetings & workshops

☑ People at community sessions

☑ Online comments / survey responses

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5.0

ISSUES AND OPPORTUNITIES

5. ISSUES AND OPPORTUNITIES

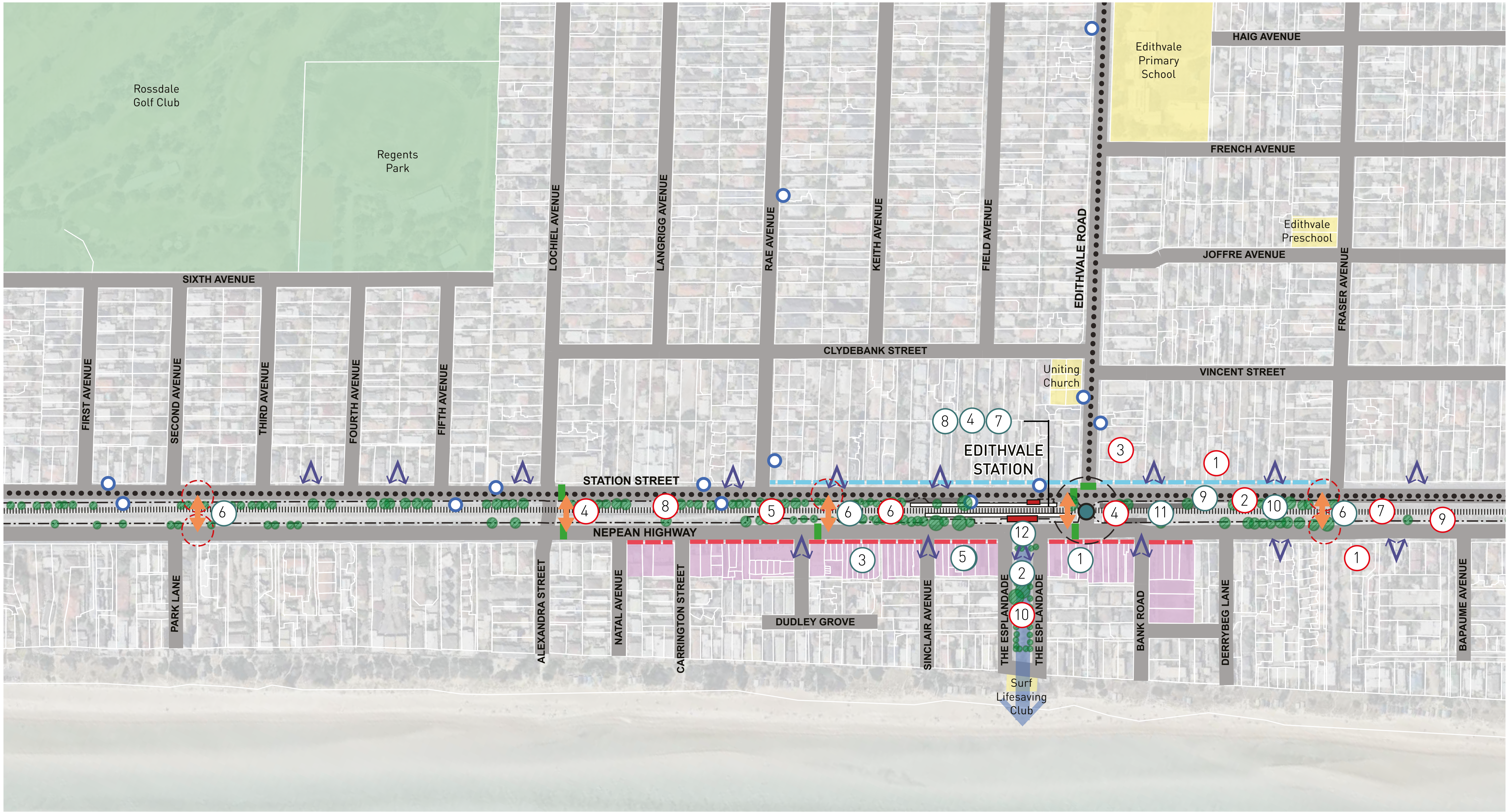

Figure 24 - Issues and Opportunities Analysis

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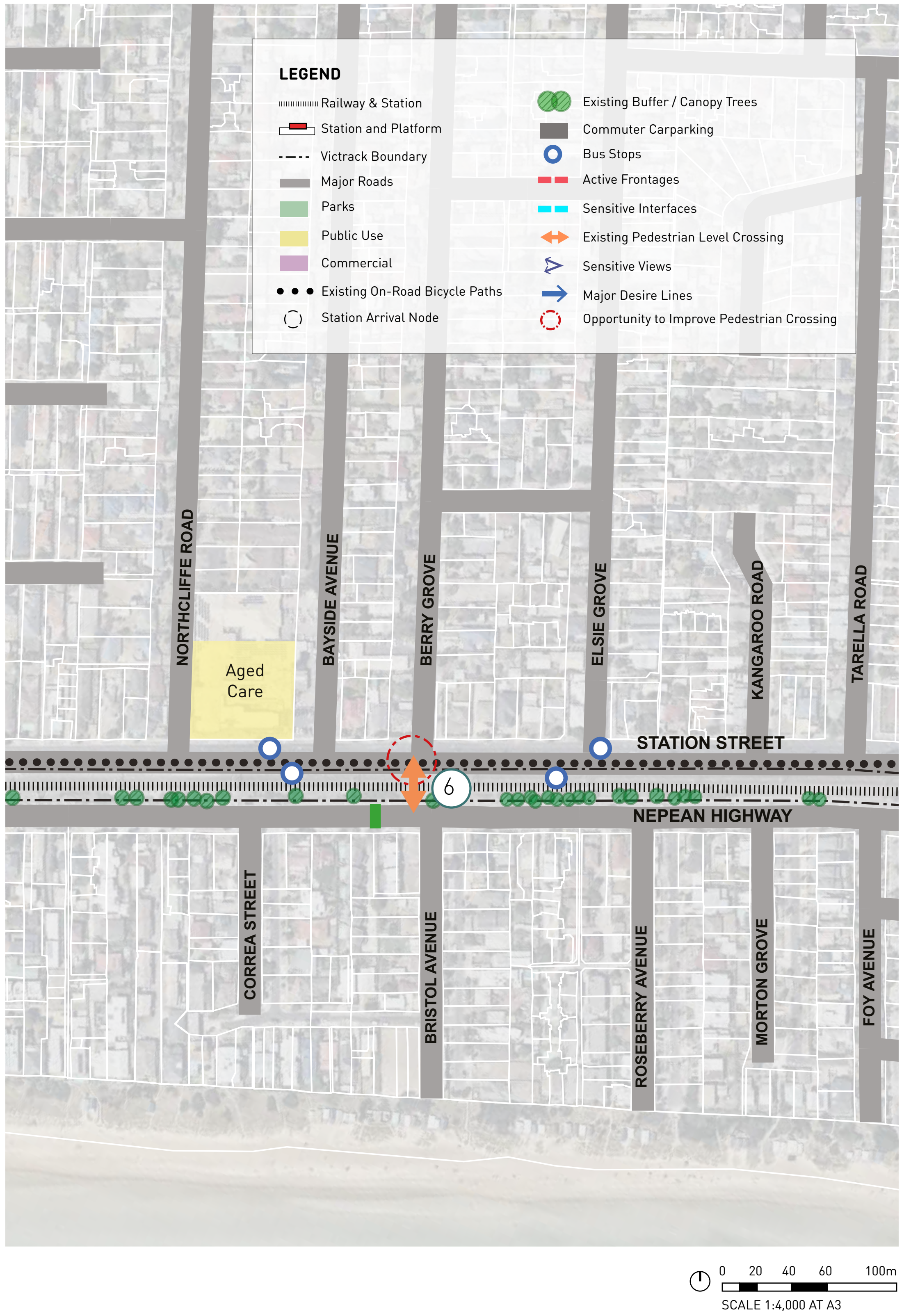

Based on the preceding analysis presented in this document, there are a number of issues and opportunities for the project site that the guidelines address. It is expected that design teams may identify further issues and opportunities through their analysis.

These are summarised below:

ISSUES

① Proximity of residential uses along the length of the rail corridor, which may be sensitive to visual and noise impacts.

② The narrow configuration of Station Street and Nepean Highway either side of the rail line which restrict the amount of space available for all modes of transport, particularly pedestrians.

③ Limited pedestrian access between residential housing on the east of the rail corridor and local destinations to the west.

④ Poor pedestrian crossing amenity and safety at existing road intersections.

⑤ Limited space available within the rail corridor to accommodate significant planting.

⑥ Discontinuous and low grade planting along the rail corridor.

⑦ Operational and design standards of road and rail infrastructure that may limit additional planting opportunities.

⑧ Protection of landscape values related to the Edithvale-Seaford Wetlands.

⑨ Unsafe car parking along Nepean Highway which encourages pedestrians to informally cross the road.

⑩ Poor visual outlook of station building from Beeson Reserve.

OPPORTUNITIES

① Provision of better local access to the Neighbourhood Centre along Nepean Highway and recreational and foreshore spaces opposite the station.

② Better visual and physical integration of the station precinct with Beeson Reserve and the foreshore.

③ Enhancement of the existing streetscape and public realm character of the area that is considerate of the existing built form and streetscape of the Neighbourhood Centre.

④ Provision of a built form outcome that responds to heritage and civic elements in the area and strengthens the quality of the local built form.

⑤ Improved views towards the rail corridor from surrounding uses on parallel streets.

⑥ Provision of additional pedestrian crossing opportunities over the rail corridor.

⑦ Improvements to the Edithvale Road/Station Street/ Nepean Highway intersection to provide additional crossing opportunities.

⑧ Improvements to the customer and public transport facilities at Edithvale Station.

⑨ Provision of safe and improved walking and cycling infrastructure along length of the rail corridor.

⑩ Improvements to the safety, location, access and number of car parking spaces.

⑪ Provision of planting to support the landscape and character of the local area.

⑫ Enhance visual and physical links to open space and recreational amenities.

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6.0

DESIGN GUIDELINES

6.1 GUIDELINES STRUCTURE

6.2 VISION

6.3 DESIGN GUIDELINES

6.4 DESIGN GUIDELINE PROJECT SECTIONS

6. DESIGN GUIDELINES

6.1 GUIDELINES STRUCTURE

There are three parts to the design guidance:

(1) VISION

The vision statement (set out in Section 6.2) puts forth the ambition of the level crossing removal for the Edithvale Road, Edithvale level crossing site. It is site specific and has been developed based on advice and input from the Urban Design Advisory Panel (UDAP).

(2) STRATEGIC OBJECTIVES

The strategic objectives are high level performance outcomes underpinning the vision and drafted for each principle, which must be achieved through the design response.

(3) DESIGN GUIDELINES

The design guidelines are more targeted and outline how the design response should achieve the principles within the Urban Design Framework. The guidelines are not based on a reference design for a single preferred option, but rather are intended to apply to all options. Further design innovation is encouraged, to better achieve the project objectives and vision.

The design guidelines set out in this section, are structured in 3 main parts, as illustrated in Figure 25. The guidelines set out site specific performance outcomes and design requirements, that must be achieved for the Edithvale Road, Edithvale site.

ROLE OF GUIDELINES

While the guidelines have been prepared as a requirements document to direct the Alliance's design response, it is not intended to preclude further design innovation.

The guideline provisions address urban design matters, primarily built form, movement and landscaping elements. It covers requirements for three urban contexts, including the station precinct, the transition zone between the station and the wider precinct, and the corridor and wider precinct area (Refer to Figure 26). This concept has been adapted from the model established by VicRoads for some of the early level crossing removal projects.

The design guidelines have been shaped by the preceding analysis, community and stakeholder engagement, and broader urban design principles, objectives and standards set out in the Urban Design Framework.

The guideline provisions have been developed according to the overarching UDF principles, and design considerations noted in Table 1, for the different contexts.

Figure 25 - Urban Design Guidelines Structure

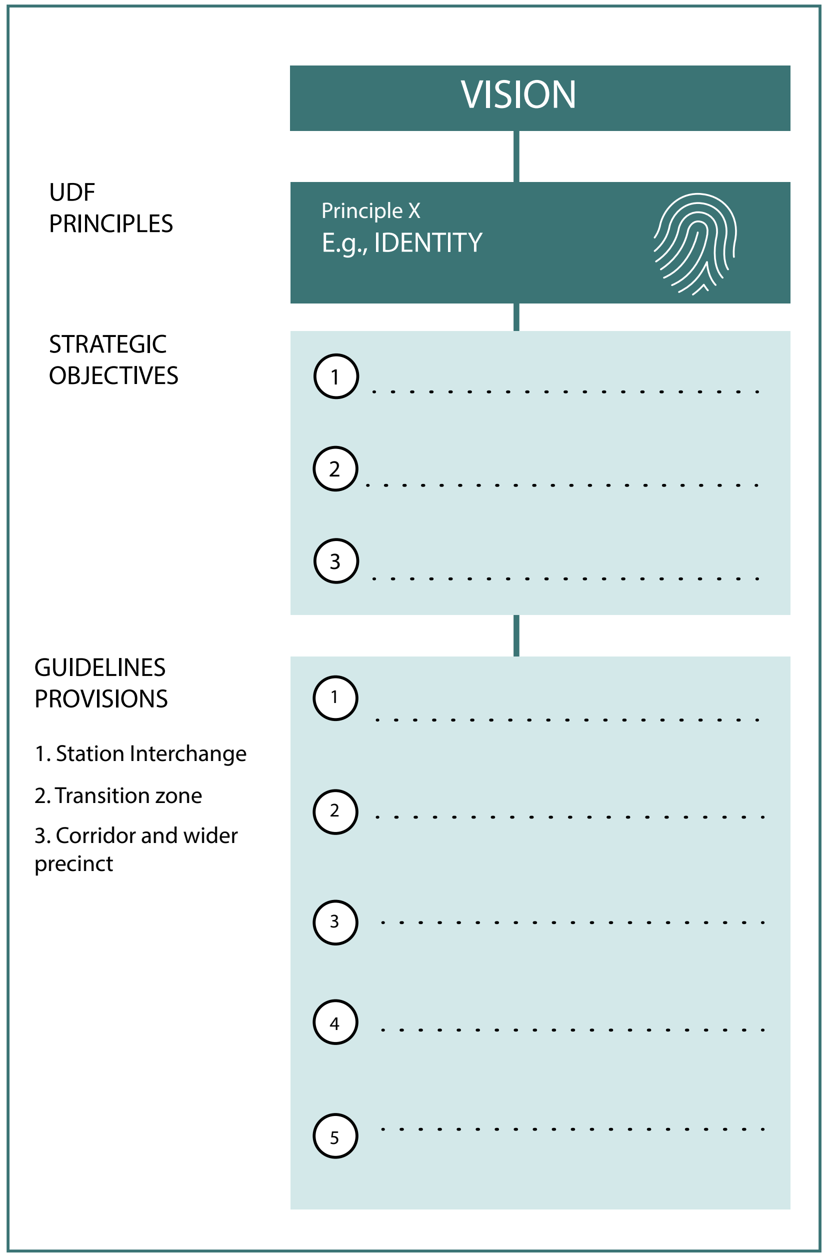
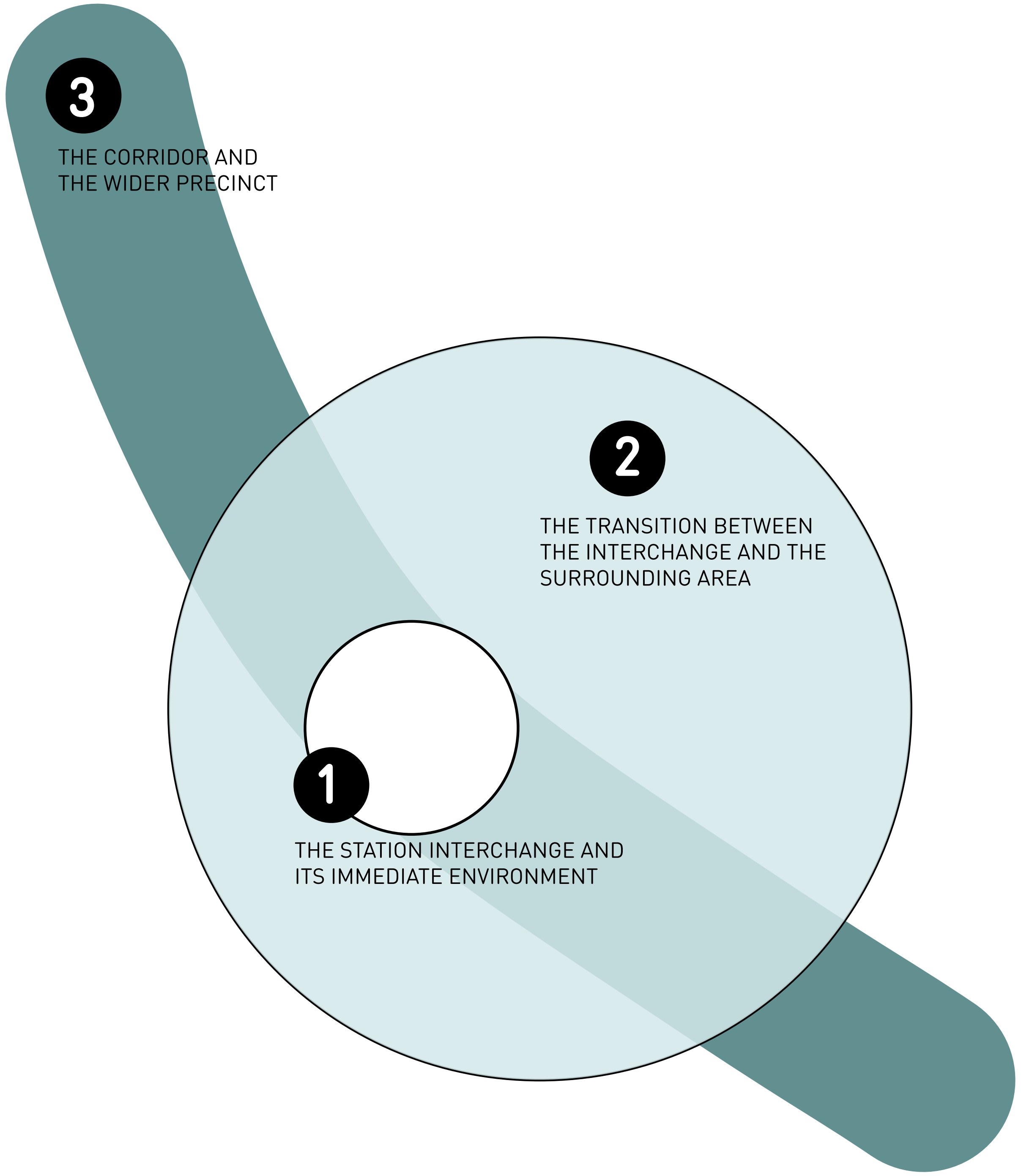


Figure 26 - Urban Contexts


3
THE CORRIDOR AND THE WIDER PRECINCT
2
THE TRANSITION BETWEEN THE INTERCHANGE AND THE SURROUNDING AREA
1
THE STATION INTERCHANGE AND ITS IMMEDIATE ENVIRONMENT

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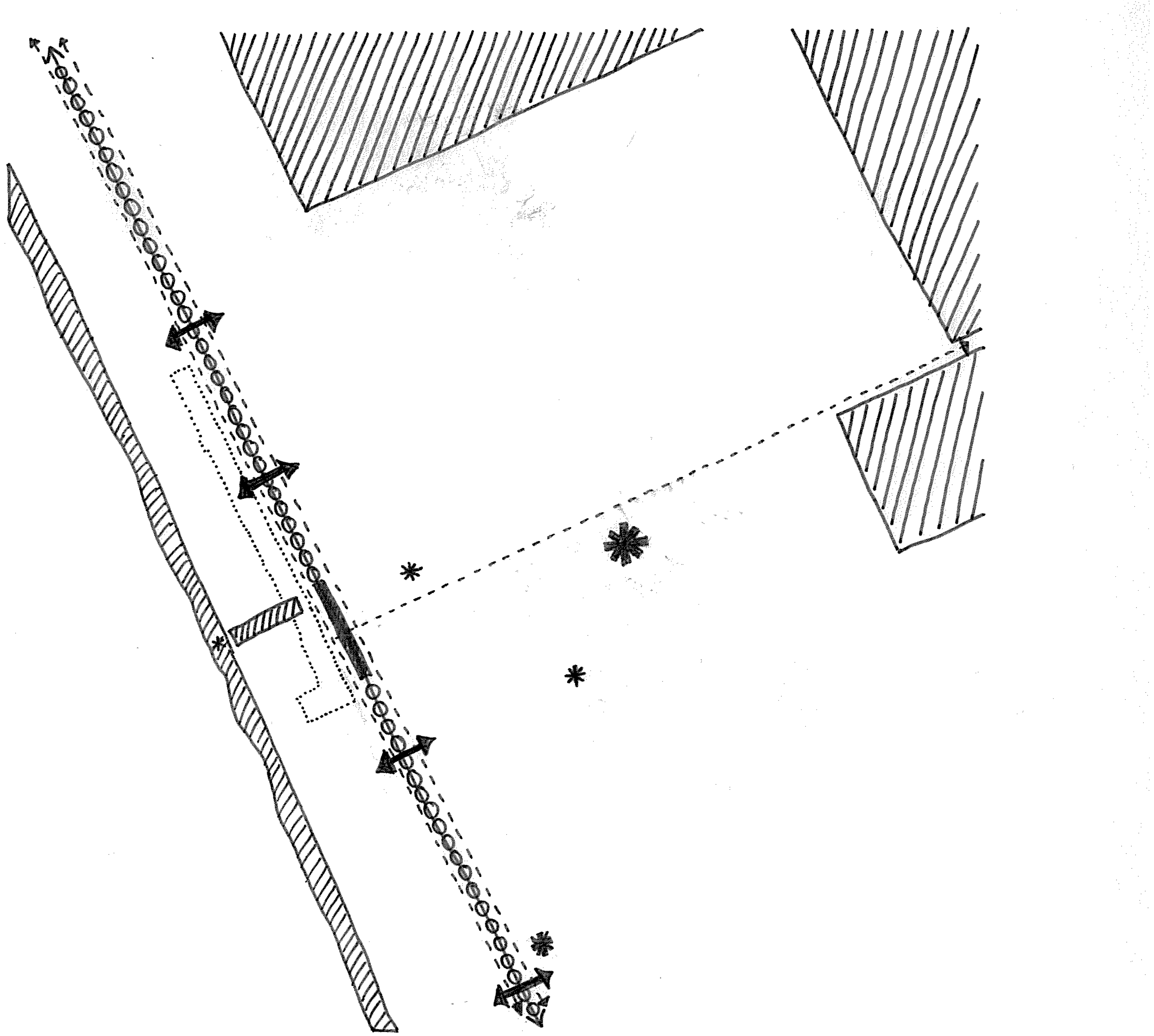
6.2 VISION

The Edithvale Road, Edithvale Level Crossing Removal Project will create a high quality and lasting local landmark that will strengthen the coastal and landscape character of the rail corridor and enhance the attractiveness of the Edithvale Neighbourhood Centre. Once complete, the project will enhance surrounding public spaces by improving walking and cycling connections and other transport access.

Figure 27 - Edithvale Strategic Objectives Overview



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6.3 DESIGN GUIDELINES

PRINCIPLES 1 AND 3: IDENTITY + URBAN INTEGRATION

STRATEGIC OBJECTIVES

1. STRENGTHEN THE LOCAL NEIGHBOURHOOD CHARACTER

   The design response should respond to and complement the existing built form and public realm character of Edithvale to create a cohesive neighbourhood centre.

2. PROTECT AND STRENGTHEN THE COASTAL LANDSCAPE

   The local landscape character should establish a sense of place that is specific to Edithvale by referencing and integrating existing species found in Beeson Reserve, along the rail corridor and on the foreshore.

3. INTEGRATE THE STATION WITH THE NEIGHBOURHOOD CENTRE

   Create a cohesive station precinct and neighbourhood activity centre through design detail and visual cues.

4. MINIMISE POTENTIAL VISUAL AMENITY IMPACTS

   The design should minimise or address visual amenity impacts to sensitive interfaces along the rail corridor and ensure that the station design and landscaping maintain and enhance key viewlines from adjacent public places and from key streets.

GUIDELINES

① The scale, materials, textures and colours of the station building must respond to and complement the prevailing low scale, modest, coastal character of the surrounding area. Including. The use of natural materials, colours, and textures should be prominently used throughout the design, as appropriate.

② Maintain some continuity of design detail, materials and forms used in other Frankston Railway Line projects, especially the Bonbeach, Carrum and Seaford Level Crossing Removal projects.

③ Provide an integrated design response to fencing, barriers and pedestrian overpasses located along the rail corridor that are consistent with the character and quality of the station building, and provides visual interest at both pedestrian and passing vehicle scales.

④ Integrate high quality public realm materials, details and landscaping into the station plaza and vegetation into the surrounding streetscapes including Edithvale Road, Nepean Highway and Station Street that is consistent with Council's Activity Centre Streetscape Suite.

⑤ Design fencing or landscaping around the perimeter of the electrical substation to provide a positive, high quality interface from residential outlooks and passing traffic along Station Street and Nepean Highway.

⑥ Create a positive landmark with built form and landscape at the terminus of the view from Beeson Reserve that identifies the centre of Edithvale and the neighbourhood centre, and establishes an appropriately high-quality precedent for the future renewal of the Edithvale Surf Life Saving Club.

⑦ Provide a high quality terminus view of the rail corridor from local streets that intersect with Station Street and Nepean Highway through landscaping or public realm/built form detailing, particularly Rae Avenue, Edithvale Road, Fraser Avenue, Northcliffe Road, Berry Avenue, and Elsie Grove.

⑧ Avoid additional road barriers through the considered location and specification of any built form and significant canopy trees outside of VicRoads prescribed clear zones along Nepean Highway and Station Street, or securing any possible waivers and exemptions.

⑨ Ensure any advertising signage within the rail corridor does not dominate the public realm or detract from the architectural design intent and landscaping of the station precincts and rail corridor, particularly at the terminus of views from local streets.

⑩ Minimise or manage light spill from station buildings and car parking to sensitive land uses adjacent to the rail corridor such as housing and retail within the Edithvale neighbourhood centre.

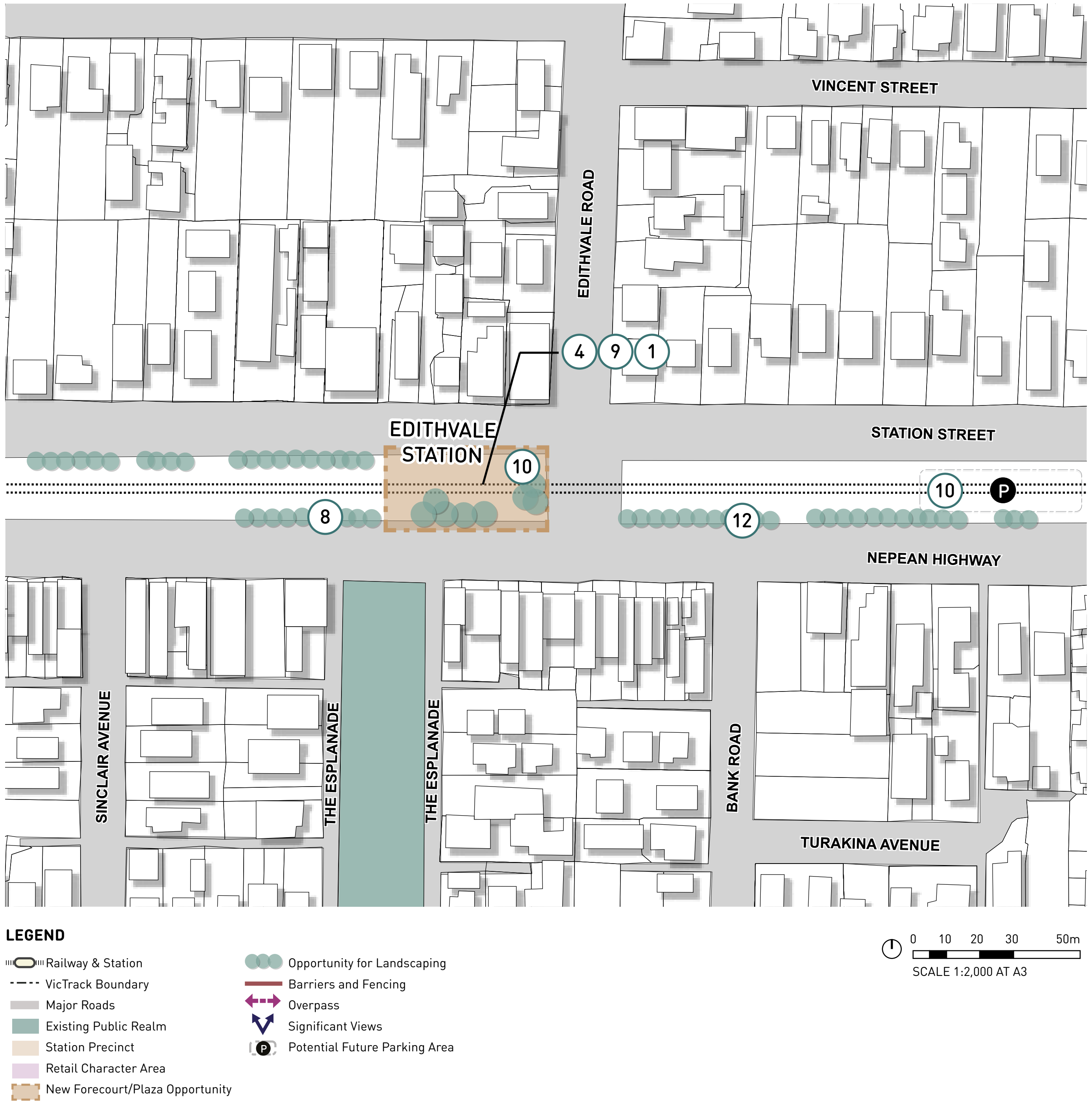
⑪ Provide high quality outlooks towards the rail corridor along Station Street and Nepean Highway, through the use of considered landscaping, materials, and treatments that provide positive visual outcomes.

⑫ Maximise opportunities to reinstate or establish coastal tree species, shrubs and other landscaping along Nepean Highway and Station Street to provide a visual buffer to the built form elements.

⑬ Minimise pavements along the Nepean Highway interface where continuous cycling and pedestrian movement is not required in order to maximise the landscape potential of this part of the corridor, particularly where it interfaces with the Edithvale neighbourhood centre.

⑭ Allow for trees to both sides of Station Street and Nepean Highway between car parking spaces in order to maximise street tree planting.

Figure 28 - Identity and Urban Integration Guideline Enlargement



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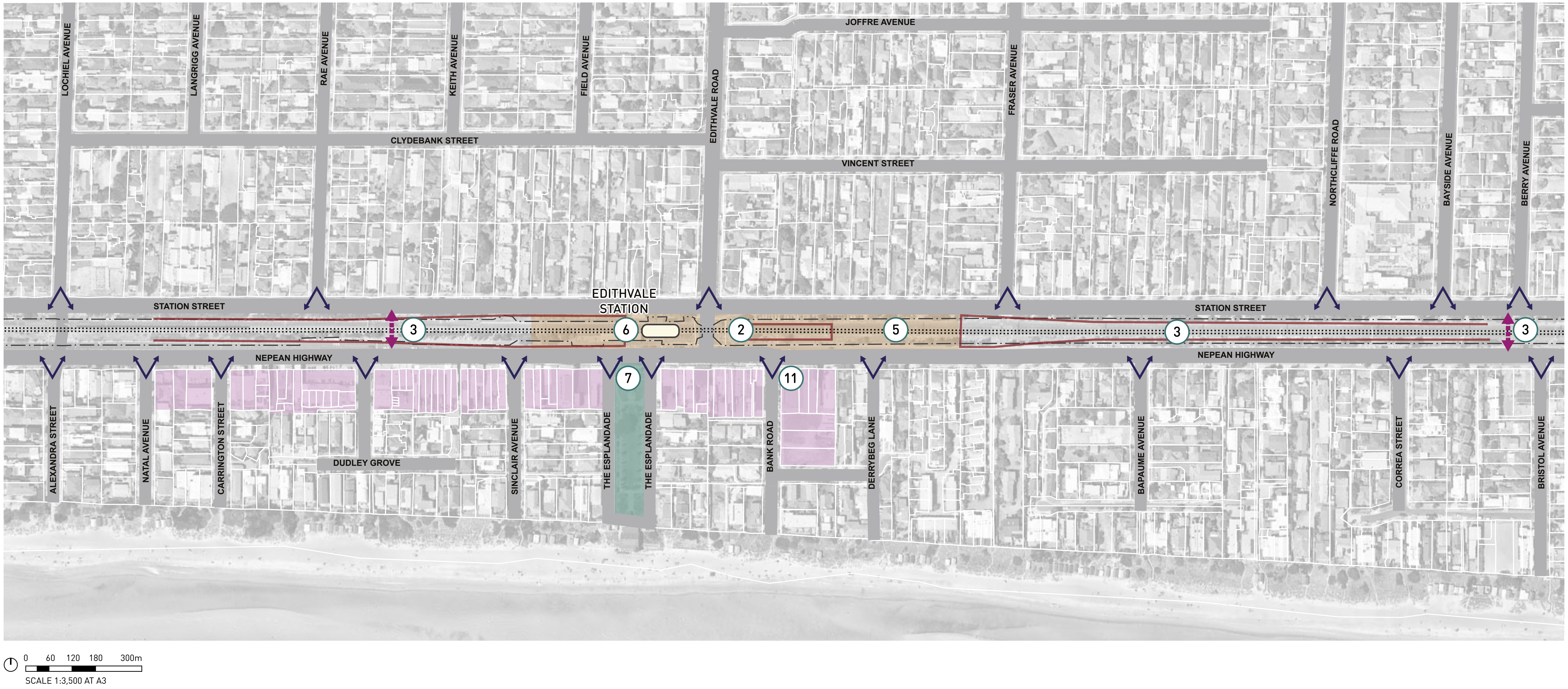
PRINCIPLES

IDENTITY	A well defined identity and sense of place are key to creating strong and vibrant communities.
URBAN INTEGRATION	Well-integrated environments provide a sound framework for the successful development of great places.

Figure 29 - Identity and Urban Integration Guideline Plan



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6.3 DESIGN GUIDELINES

PRINCIPLES 2 AND 8: CONNECTIVITY AND WAYFINDING + ACCESSIBILITY

STRATEGIC OBJECTIVES

1. IMPROVE CONNECTIVITY TO THE STATION

The design response should improve and establish connections that are safe and direct for all modes of transport. The design response should also provide safe and direct inter-modal connections.

PRIORITISE ACTIVE TRANSPORT MODES

The design and arrangement of the precinct shall prioritise the safety and amenity of pedestrians and cyclists over private vehicles, to encourage use of active transport modes to access the station.

2. PROVIDE A UNIVERSALLY INCLUSIVE DESIGN

Ensure the design provides universal access to all public spaces and the station and promotes equity for all users and mobilities.

GUIDELINES

① Integrate the network plans for all modes of transport in the station precinct, with a priority for pedestrian movement in proximity to the station, Beeson Reserve and the Edithvale neighbourhood centre.

② Provide dedicated walking and cycling infrastructure along the Station Street side of the rail corridor that provides for safe pedestrian and cycling movements along this corridor, as well as, to the station and the neighbourhood centre from the broader precinct.

③ Establish clear and direct pedestrian linkages between the station entrances to bus bays, commuter carparking, and bicycle storage locations.

④ Reinstate pedestrian crossings over the rail corridor with DDA compliant overpasses at Denman Avenue and Berry Avenue and incorporate stair access where in order to maximise their accessibility from all directions.

⑤ Provide an at-grade pedestrian crossing over the rail corridor at Fraser Avenue with a minimum width of 4.0 metres that provides a direct and safe connection between Station Street and Nepean Highway.

⑥ Provide clear, intuitive and suitable wide paths at accessible slopes that allow for ease of movement for pedestrians around the station to car parking and pedestrian crossing/overpass locations and provide an adequate clearance from traffic lanes.

⑦ Maintain and enhance sightlines to landmarks such as Beeson Reserve and the foreshore from the station precinct to assist the orientation of users.

⑧ Locate bus bays to be clearly visible and identifiable from both station entrances and the Edithvale neighbourhood centre and provide for the safe movement of pedestrians to bus stops from surrounding uses.

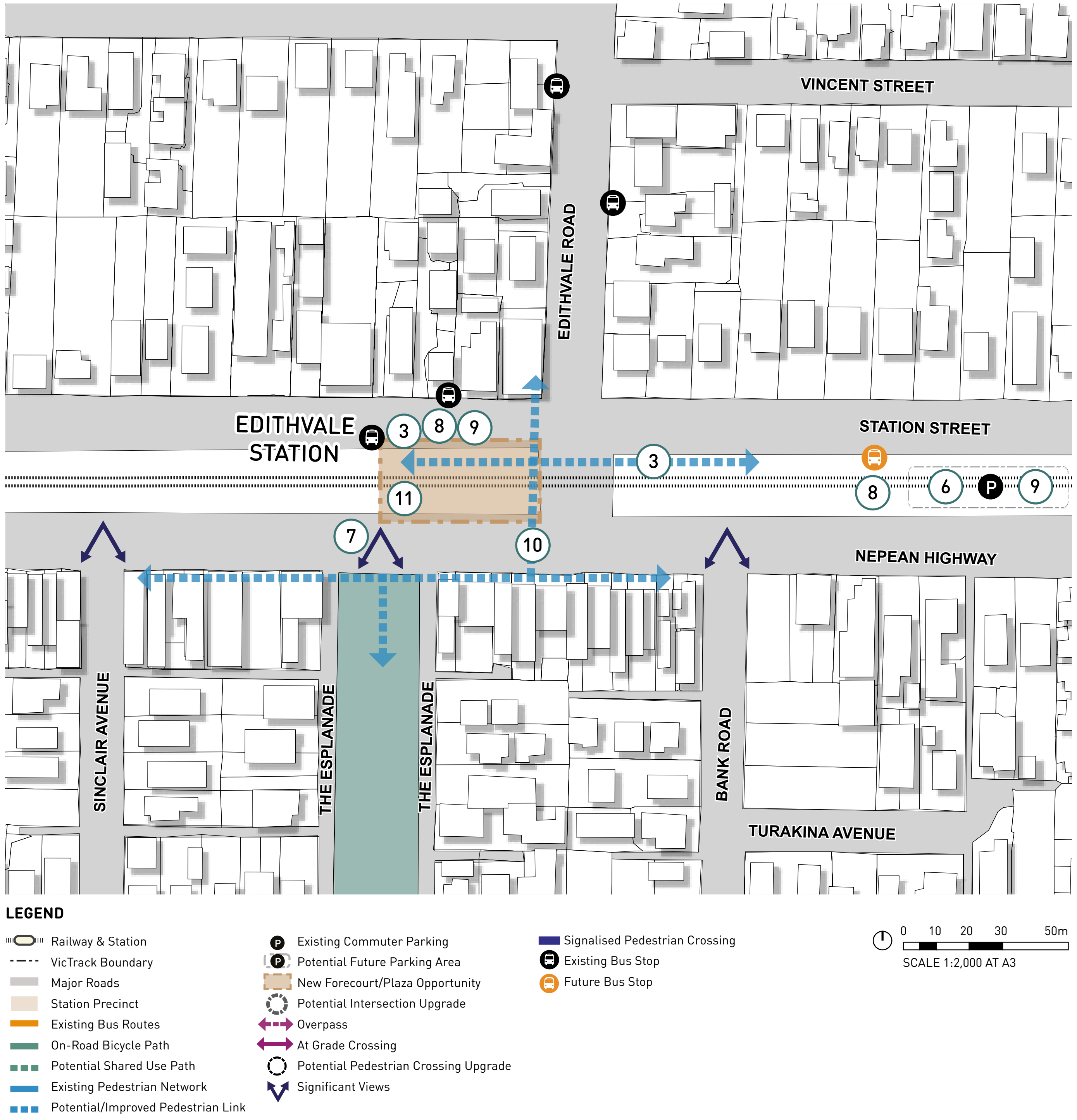
⑨ Locate commuter car parking and bus bays in close proximity to a station entrance.

⑩ Provide generous and functional pathways around the station precinct that address key desire lines to station amenities, local streets, and adjacent destinations.

⑪ Locate all bicycle parking to be visible and have direct access from the station entrance and cycling infrastructure along Station Street.

⑫ Orient and locate pedestrian overpasses to minimise impacts on existing pedestrian journey times to key local features.

Figure 30 - Accessibility, Connectivity and Wayfinding Guidelines Enlargement



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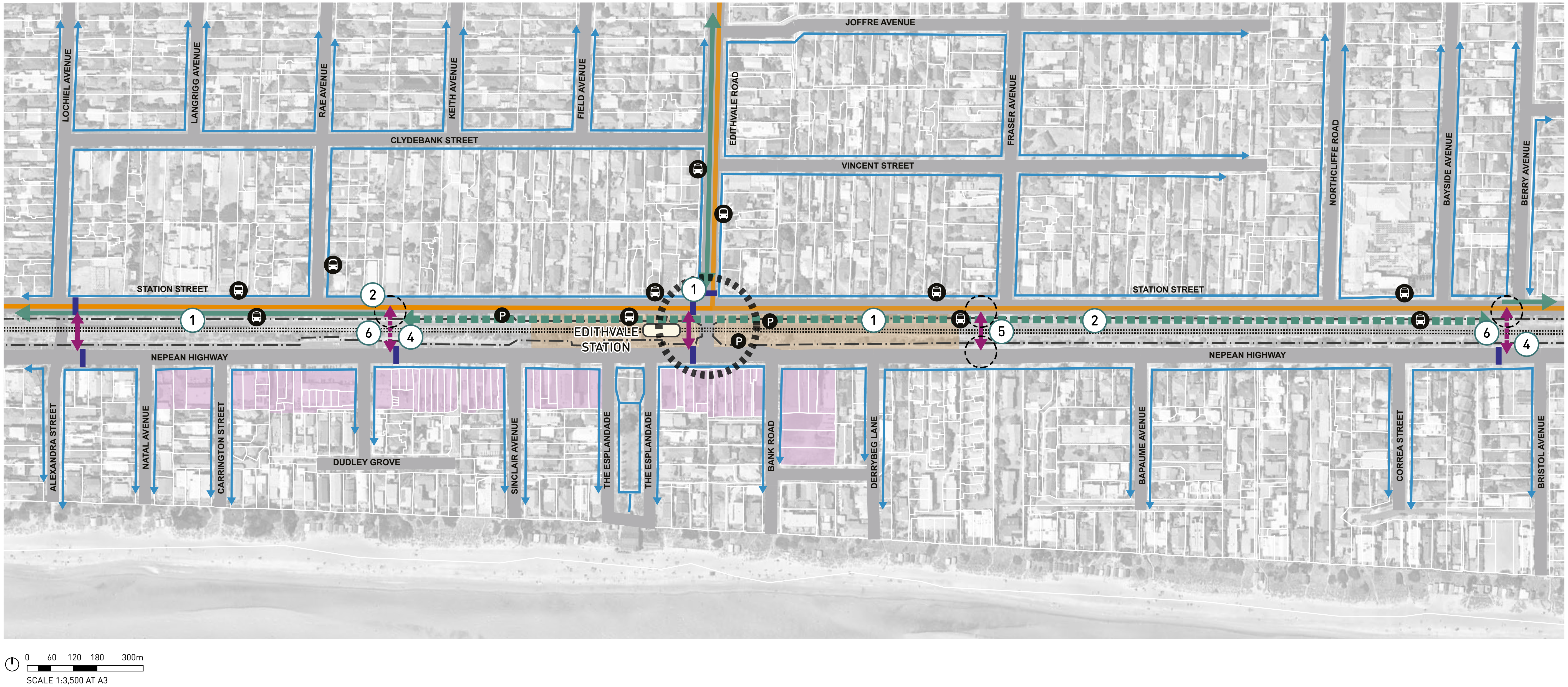
PRINCIPLES

CONNECTIVITY AND WAYFINDING	Well connected and legible places contribute significantly to strong economies and healthy, inclusive communities.
ACCESSIBILITY	Highly accessible and inclusive environments encourage positive activation and contribute to prosperity, well being and the perception of care within communities.

Figure 31 - Accessibility, Connectiity and Wayfinding Guidelines Plan



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6.3 DESIGN GUIDELINES

PRINCIPLES 5 AND 7: AMENITY + SAFETY

STRATEGIC OBJECTIVES

1. ENHANCE A SENSE OF SAFETY

   Design the station precinct to feel safe through passive surveillance opportunities and the elimination of conflicts between modes and users.

2. IMPROVE USER COMFORT

   Incorporate measures across the station precinct to enhance user enjoyment such as shade, wind protection, public amenities in appropriate locations.

GUIDELINES

① Maximise visual connections and transparency between the station platform to the station concourse and to pedestrian activity along Station Street and Nepean Highway.

② Ensure a large proportion of the platform is open to the sky for natural sunlight and to provide passive surveillance opportunities over the station platform from Station Street and Nepean Highway.

③ Ensure well-lit platforms that provide high-levels of illumination that reduce the contrast between day-lit and artificially lit areas of the platform to assist visibility of users and improve the sense of safety.

④ Ensure walking and cycling infrastructure and any highly pedestrianised areas are designed to minimise conflicts issues between users through clear delineation of spaces and traffic management measures, particularly at the station entrances.

⑤ Ensure the platform environment is a comfortable, well-lit, and inviting space for users and commensurate with an internalised space with high-quality materials on floor, wall and ceiling surfaces.

⑥ Provide weather protection, lighting, comfortable seating and public amenities, such as waste bins and drinking fountains in appropriate locations in the station precinct.

⑦ Integrate generous shelters and awnings as part of the station building and entrances to provide weather protection for station users as they enter or exit the station, and wait or prepare for other forms of transport.

⑧ Provide public seating at both of the station entry forecourts to assist in trip staging and opportunities to pause, and integrate with other furniture, signage and other project elements to minimise clutter.

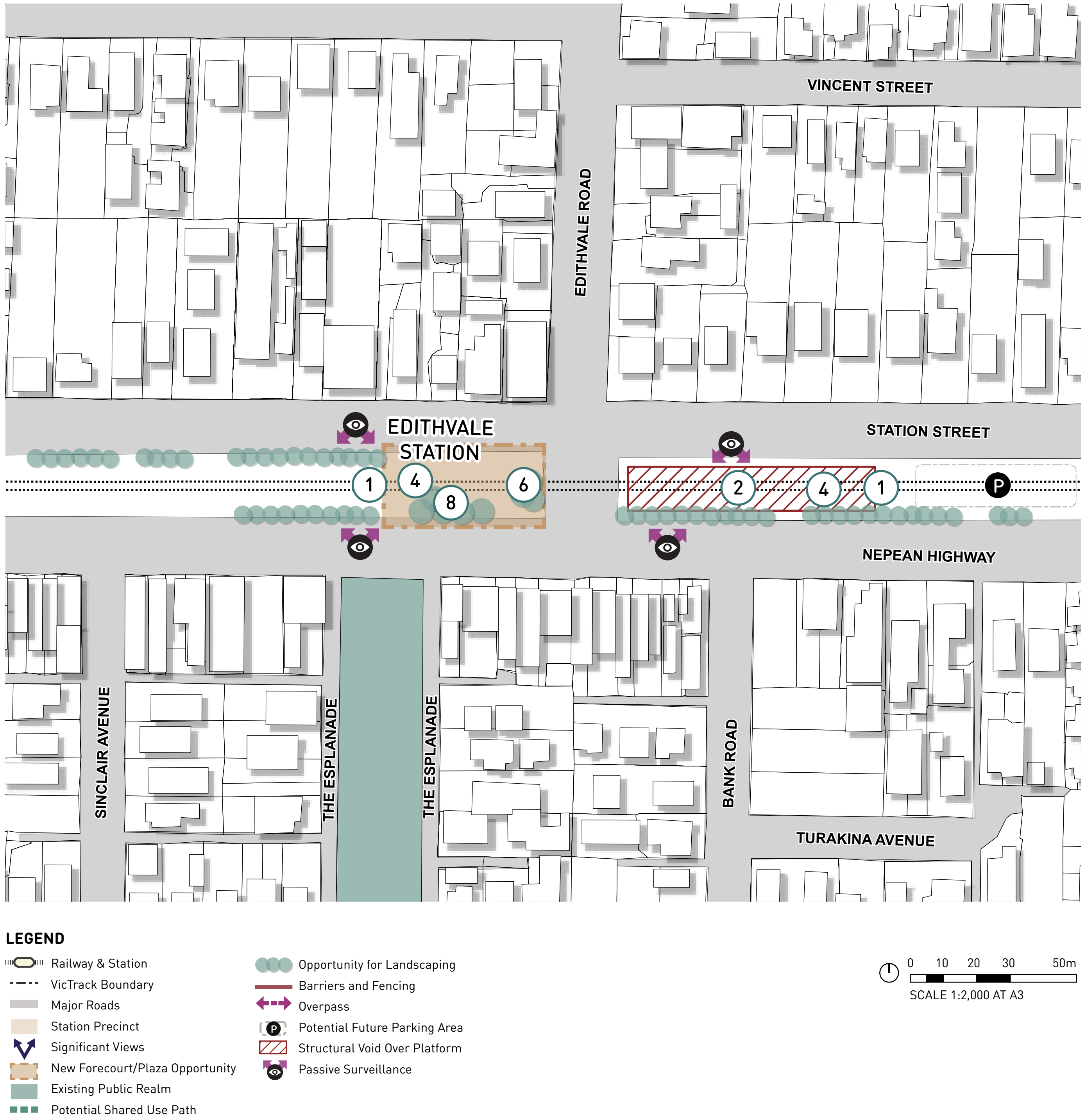
⑨ Provide treatments to the rail cutting that are high quality and visually interesting for rail passengers and station users and establishes a positive sense of arrival into Edithvale Station.

⑩ Use tree planting along the road/rail corridor to provide shade and shelter elements to pedestrian and cycling infrastructure and to car parking.

⑪ Design and detail all pedestrian overpasses to maintain a high level of visibility of users from street level through transparent materials,wide pathways and clear viewlines.

⑫ Maintain adequate clearances between pedestrian paths and overpasses to traffic lanes along Nepean Highway and provide landscaping and other treatments to provide users with a sense of safety.

Figure 32 - Amenity and Safety Guidelines Enlargement



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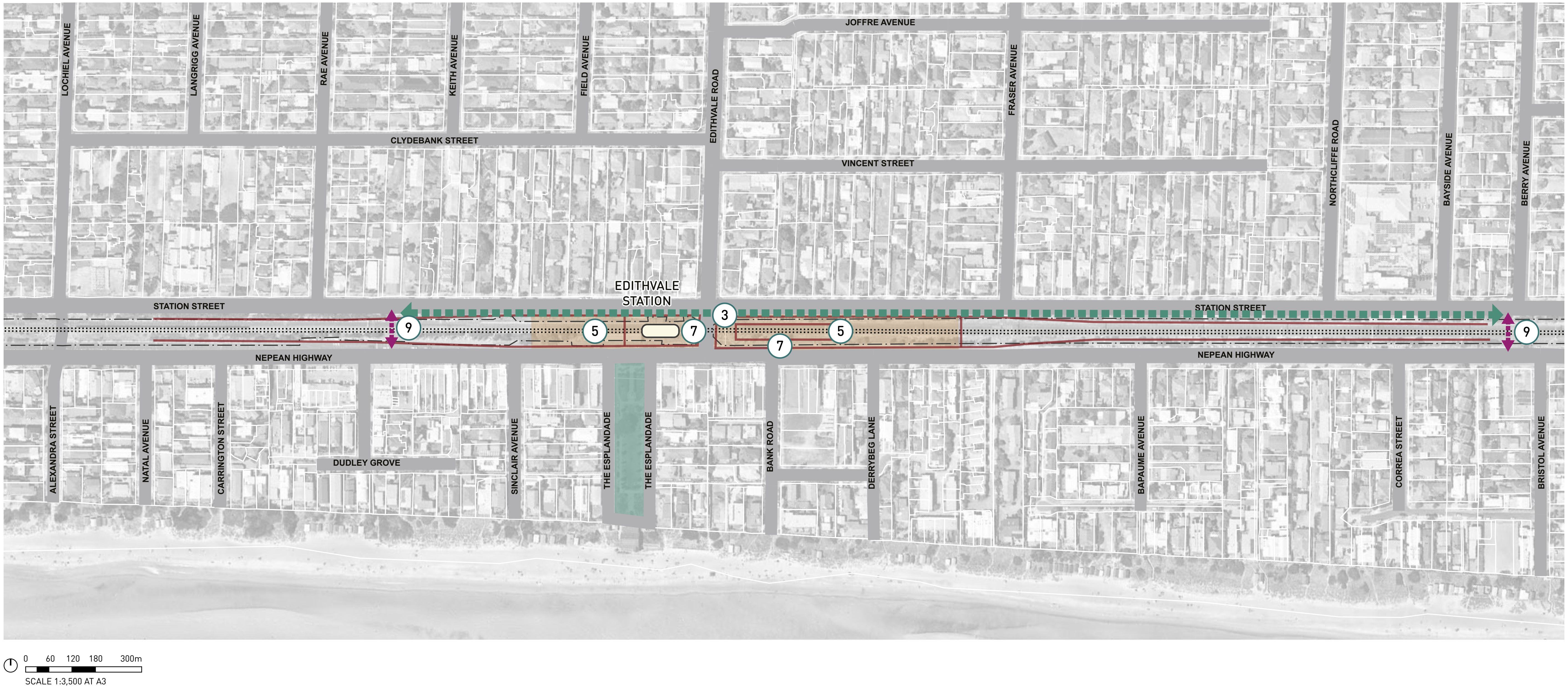
PRINCIPLES

☆ AMENITY	High quality urban amenity associated with access to services and the experience of great public places contributes to successful, equitable and prosperous communities.
SAFETY	Safe environments are essential for strong, connected and happy communities.

Figure 33 - Amenity + Safety Guidelines Plan



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6.3 DESIGN GUIDELINES

PRINCIPLE 6: VIBRANCY

STRATEGIC OBJECTIVES

1. LINK THE STATION WITH NEIGHBOURHOOD CENTRE USES

   Enhance the precinct by better integrating the station with the existing uses contained within the Edithvale neighbourhood centre and to the recreational amenities in the area.

2. PROVIDE A HIGH QUALITY AND FUNCTIONAL PUBLIC REALM

   Create an inclusive and people oriented public realm at the station that supports social interaction and accommodates a range of uses and movements.

GUIDELINES

① Locate the main station entrance to be north of Edithvale Road to maintain physical and visual links with the existing neighbourhood centre and key beach access point.

② Orient station entry points towards Station Street, where key cycling and pedestrian links are provided and vehicle traffic is less predominant, whilst maintaining visual links to activities along Nepean Highway.

③ Enhance pedestrian connectivity between the station precinct and the Edithvale neighbourhood centre and Beeson Reserve.

④ Ensure that any built form provides a positive address to the uses that form part of Edithvale neighbourhood activity centre along Nepean Highway and to Beeson Reserve, to strengthen their function as a local shopping and community hub.

⑤ Minimise inactive and blank walls adjacent to highly pedestrianised areas, including the station plaza and car parking, and to any built form visible from the Edithvale neighbourhood centre and Beeson Reserve.

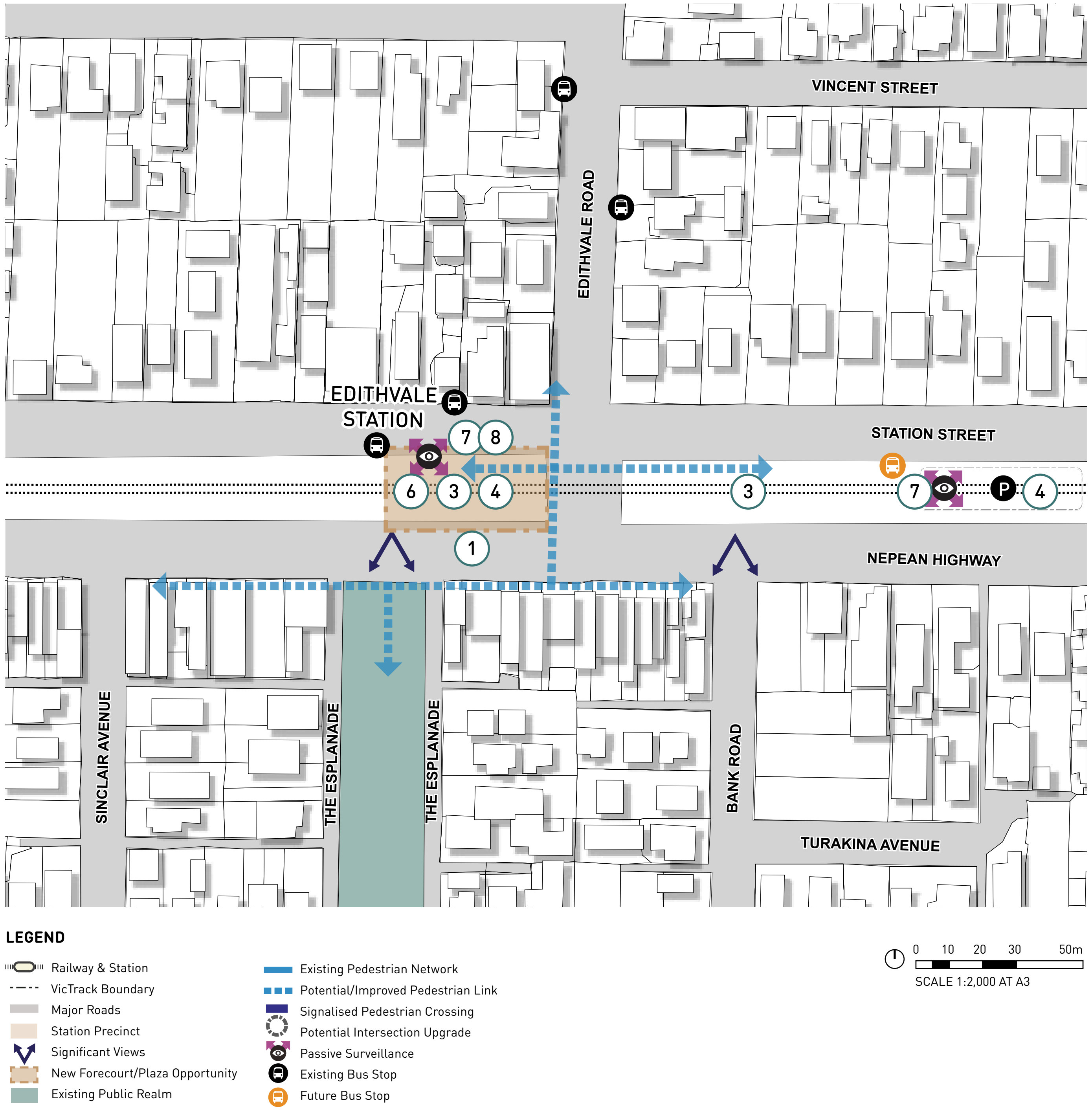
⑥ Minimise the visibility of utilities, infrastructure and back of house functions from the Edithvale neighbourhood centre, Beeson Reserve, main pedestrian through-paths and gathering areas.

⑦ Provide a suitably generous station plaza space that accommodates public amenities such as seating, lighting, and furniture, in addition to space required for pedestrian and cycle through-paths.

⑧ Orient and design the station kiosk and any staff and customer amenities to maximise passive surveillance over the station plaza, bus bays and to pedestrian activity along Station Street.

⑨ Maximise activity at the station entrance by co-locating uses such as bus bays, kiss and ride and pedestrian crossings with the station plaza along Station Street.

Figure 34 - Vibrancy Guideline Enlargement



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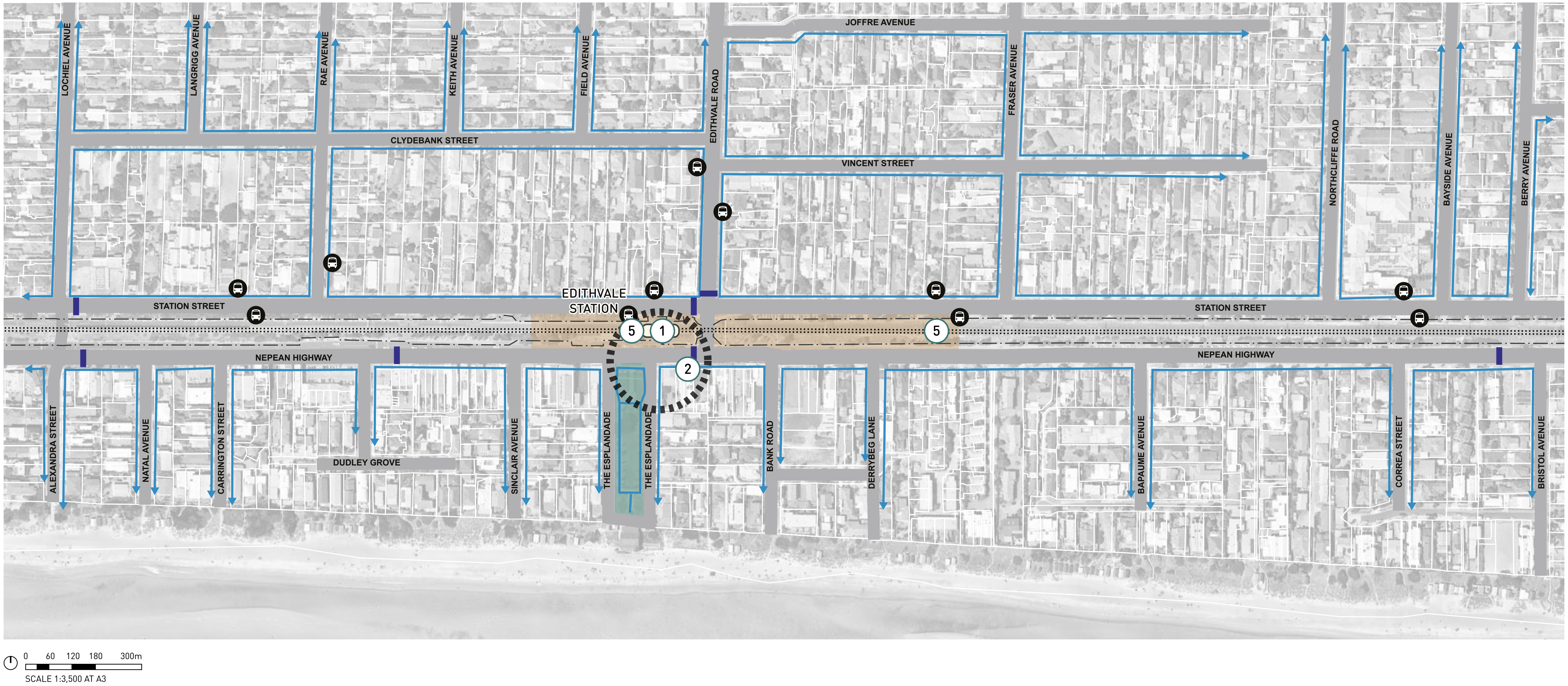
PRINCIPLE

VIBRANCY Animation of key civic spaces, and diversity in the experience of urban places support prosperous and healthy communities.

Figure 35 - Vibrancy Guideline Plan



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6.3 DESIGN GUIDELINES

PRINCIPLE 4: RESILIENCE AND SUSTAINABILITY

STRATEGIC OBJECTIVES

1. PROMOTE SUSTAINABLE DESIGN

   Ensure the station building and landscaping integrates sustainable design concepts that allow for efficient water, waste and energy use, conservation and re-use.

2. CREATE A SITE RESPONSIVE DESIGN

   Draw on a comprehensive site and context analysis to inform the design of the precinct and landscaping and building details.

3. CREATE A LASTING STATION PRECINCT

   Provide a design that demonstrates a high standard of architectural design and addresses the current and future needs of all users.

GUIDELINES

① Specify a material palette for the public realm hardscape (footpaths, fences, barriers, walls, paved areas) that is high quality, durable, low maintenance, and minimises opportunities for graffiti and is resilient in the coastal setting.

② Specify landscaping species that appropriate for the specific climatic and environmental conditions of the area such as soil types, wind, temperature, and rain conditions, and the type of physical environment created by the rail infrastructure.

③ Integrate Water Sensitive Urban Design (WSUD) into the stormwater management of the station precinct to maximise the viability of landscape and mitigate heat island effects, and explore opportunities to supply stormwater to the broader precinct including Beeson Reserve.

④ Provide permeable ground surfaces within the station precinct, where possible, for absorption of rainwater and reduction of stormwater run-off.

⑤ Maintain and establish mature and significant landscaping along the rail corridor and in the station plaza to provide shading opportunities and enhance the local habitat and microclimate.

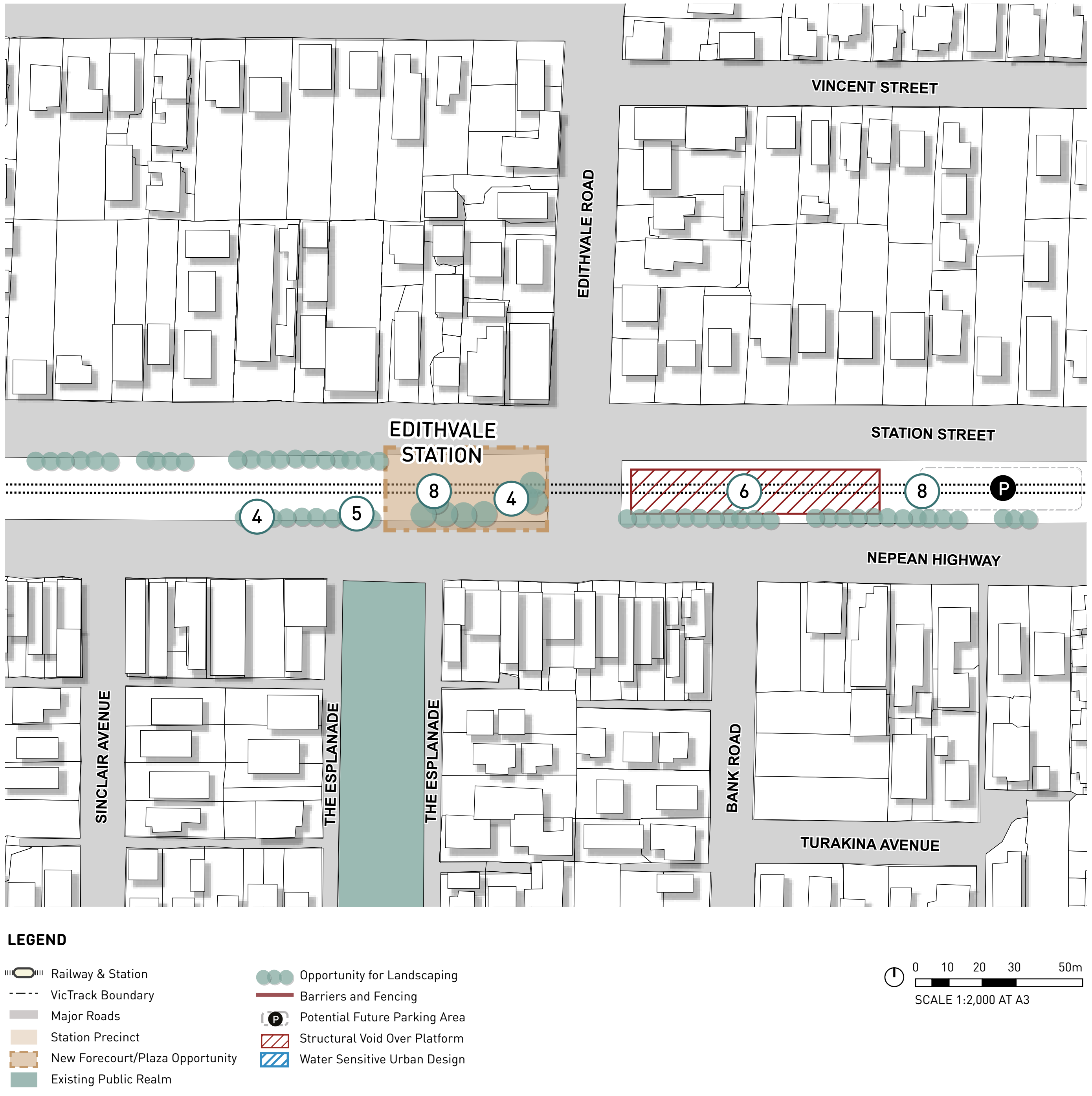
⑥ Use plant species appropriate to the coastal climatic conditions of the area and the limited available root space along the rail.

⑦ Provide a high level of natural daylight to the platform level to minimise reliance on artificial lighting.

⑧ Ensure the design and treatment of the station, plaza area, and walking and cycling paths allow for future growth in demand and patronage, and flexibility in the modes of transport that rail users will use to reach the station in the future.

⑨ Design for flexibility in the deck structures to accommodate potential changes to what they are used in future

Figure 36 - Resilience and Sustainability Guideline Enlargement



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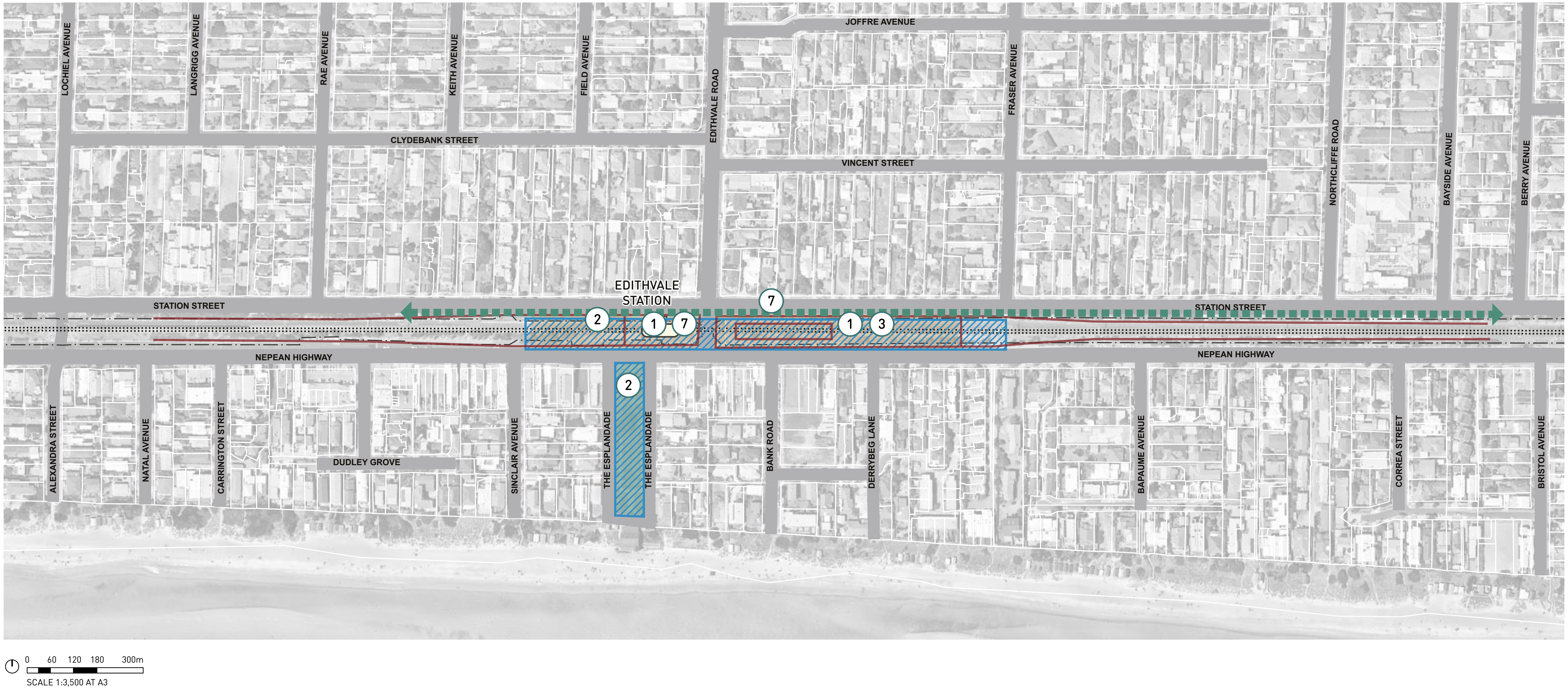
PRINCIPLE

RESILIENCE AND SUSTAINABILITY Places must be sustainable, enduring and resilient in order to support and nurture current and future generations.

Figure 37 - Resilience and Sustainability Guideline Plan



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6.4 DESIGN GUIDELINE SECTIONS

A rail under road design solution has been selected for the Edithvale level crossing removal project. The two cross sections below have been included to illustrate the spatial opportunities and constraints of the rail corridor and the potential interface with the immediately adjacent streets and features.

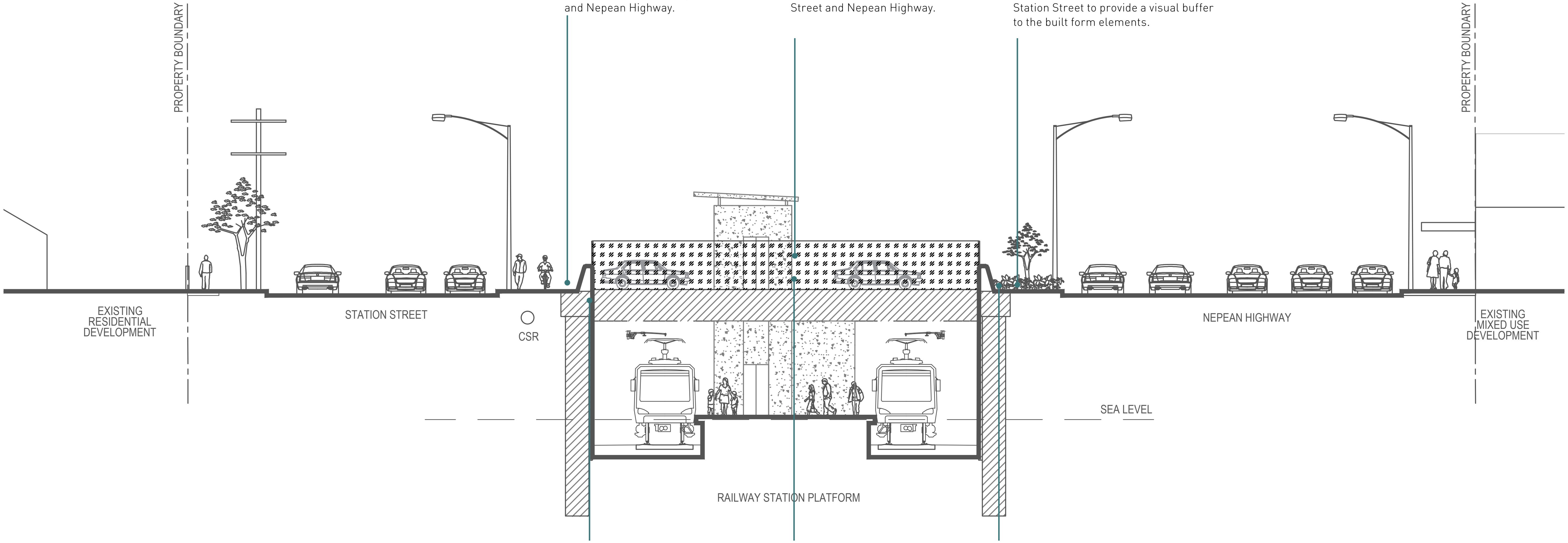
The cross sections also demonstrate how a rail under road solution can deliver on the design guidance provided in this document.

Figure 38 - Typical Station Platform Section Rail Under

High quality landscaping and fencing treatments can provide positive visual amenity outcomes along Station Street and Nepean Highway.

A large proportion of the platform can be open to the sky to provide passive surveillance opportunities from Station Street and Nepean Highway.

Coastal tree species, shrubs and other landscaping can be reinstated or established along Nepean Highway and Station Street to provide a visual buffer to the built form elements.



Visual connections and transparency between the station platform to the station concourse can be achieved.

The platform environment can be comfortable, well-lit, and inviting and commensurate with an internalised space with high-quality materials on floor, wall and ceiling surfaces.

Treatments to the rail cutting can be high quality and visually interesting for rail passengers and station users and establish a positive sense of arrival into Edithvale Station.

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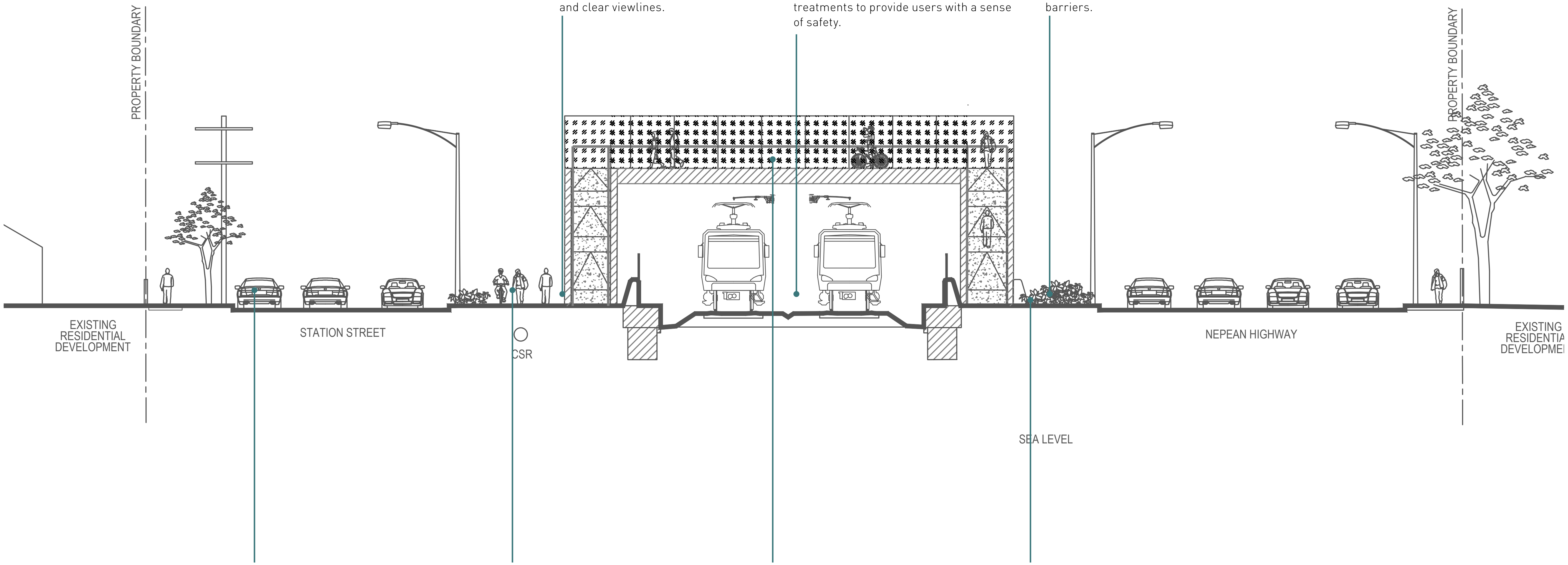
Figure 39 - Typical Overpass Section Rail Under

Pedestrian overpasses can be designed to maintain a high level of visibility of users from street level through transparent materials, wide pathways and clear viewlines.

Clearances between pedestrian paths and overpasses to traffic lanes along Nepean Highway can be provided through landscaping and other treatments to provide users with a sense of safety.

Significant canopy trees can be located outside of VicRoads prescribed clear zones along Nepean Highway and Station Street to minimise need for road barriers.



Indented roadside car parking arrangements along both Station Street and Nepean Highway can accommodate street tree planting.

The Station Street side of the corridor can accommodate safe and improved walking and cycling infrastructure along the length of the rail corridor

Fencing, barriers and pedestrian overpasses located along the rail corridor can be designed to contribute to the character and quality of the station building.

Landscaping along the corridor can provide shade and shelter to pedestrian and cycling infrastructure and to car parking.

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APPENDIX

A: GLOSSARY AND REFERENCE LIST

B: URBAN CONTEXT CONSIDERATIONS

C: STRATEGIC PLANNING BACKGROUND INFORMATION

D: DETAILED TRANSPORT ANALYSIS

APPENDIX A: GLOSSARY AND REFERENCE LIST

7.1 GLOSSARY

BPR	Bicycle Priority Routes
CBD	Central Business District
DELWP	Department of Environment, Land, Water, and Planning
EES	Environmental Effects Statement
LXRA	Level Crossing Removal Authority
MTM	Metro Trains Melbourne
OVGA	Office of the Victorian Government Architect
PBN	Principal Bicycle Network
PPR	Pedestrian Priority Routes
PRS	Project Requirements Specification
PTV	Public Transport Victoria
SPPF	State Planning Policy Framework
SUP	Shared Use Path
TFV	Transport for Victoria
UDAP	Urban Design Advisory Panel
UDF	Urban Design Framework
UDG	Urban Design Guideline
VPA	Victorian Planning Authority
WSUD	Water Sensitive Urban Design

7.2 REFERENCES

AECOM - GHD Joint Venture (2017), Frankston Corridor Urban Design Strategy, Level Crossing Removal Project

AECOM - GHD Joint Venture (August 2016), Urban Design Framework, Level Crossing Removal Project, Version 3

Australian Bureau of Statistics (2011 and 2016), Census QuickStats

Chief Parliamentary Counsel (July 2017) Planning and Environment Act 1987, Version 130

City of Kingston (October 2017), Kingston Planning Scheme, Clause 21, Planning Zones, and Planning Overlays

City of Kingston (2016), Prosperous Kingston: A Framework for Economic Sustainability

City of Kingston (2014), Kingston Residential Strategy Update

City of Kingston (2007), Kingston Neighbourhood Character Guidelines

City of Kingston (2009), Kingston Cycling and Walking Plan

City of Kingston (2006), City of Kingston Retail/Commercial Development Strategy

Public Transport Victoria (2012), Network Development Plan - Metropolitan Rail

The State Government of Victoria: Department of Environment, Land, Water, and Planning (2017), Plan Melbourne 2017 - 2050

The State Government of Victoria: Department of Environment, Land, Water, and Planning (2017), State Planning Policy Framework, Clause 9 to Clause 19

VicRoads (2012), Principal Bicycle Network (PBN) and Bicycle Priority Routes (BPR)

VicRoads (July 2011), SmartRoads: Connecting Communities

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7.3 FIGURE SOURCES

#	FIGURE	REFERENCE
1	Level Crossing Removal - Project Map	Level Crossing Removal Project
2	Urban Design Briefing Documents	AECOM - GHD Joint Venture (2017)
3	Methodology	AECOM - GHD Joint Venture (2017)
4	Urban Design Framework	AECOM - GHD Joint Venture (2017)
5	Regional Context Map	AECOM - GHD Joint Venture (2017)
6	Historical Timeline	AECOM - GHD Joint Venture (2017)
7	Land Use Analysis Plan	AECOM - GHD Joint Venture (2017)
8	Land Use Analysis Enlargement	AECOM - GHD Joint Venture (2017)
9	Built Form and Heritage Analysis Plan	AECOM - GHD Joint Venture (2017)
10	Built Form and Heritage Analysis Enlargement	AECOM - GHD Joint Venture (2017)
11	Transport Networks and Access Analysis Plan	AECOM - GHD Joint Venture (2017)
12	Transport Networks and Access Analysis Enlargement	AECOM - GHD Joint Venture (2017)
13	Geomorphological Map of Area	AECOM - GHD Joint Venture (2017)
14	Transport Networks and Access Analysis Plan	AECOM - GHD Joint Venture (2017)
15	Transport Networks and Access Analysis Plan	AECOM - GHD Joint Venture (2017)
16	Key Map - Edithvale Statistical Area	AECOM - GHD Joint Venture (2017)
17	Population Profile and Growth Projections	AECOM - GHD Joint Venture (2017)
18	Dwelling Profile and Growth Projections	AECOM - GHD Joint Venture (2017)
19	Dwelling Profile Comparative Analysis	AECOM - GHD Joint Venture (2017)
20	Modal Share Comparative Analysis	AECOM - GHD Joint Venture (2017)
21	Key Map = Edithvale Photographic Survey	AECOM - GHD Joint Venture (2017)
22	Engagement Phases	AECOM - GHD Joint Venture (2017)
23	Community Consultation Snapshot	AECOM - GHD Joint Venture (2017)
24	Issues and Opportunities Analysis	AECOM - GHD Joint Venture (2017)
25	Urban Design Guidelines Structure	AECOM - GHD Joint Venture (2017)
26	Urban Contexts	AECOM - GHD Joint Venture (2017)
27	Edithvale Strategic Objectives Overview	AECOM - GHD Joint Venture (2017)
28	Identity and Urban Integration Guideline Enlargement	AECOM - GHD Joint Venture (2017)
29	Identity and Urban Integration Guideline Plan	AECOM - GHD Joint Venture (2017)
30	Accessibility, Connectivity and Wayfinding Guideline Enlargement	AECOM - GHD Joint Venture (2017)
31	Accessibility, Connectivity and Wayfinding Guideline Plan	AECOM - GHD Joint Venture (2017)
32	Safety and Amenity Guideline Enlargement	AECOM - GHD Joint Venture (2017)
33	Safety and Amenity Guideline Plan	AECOM - GHD Joint Venture (2017)
34	Vibrancy Guideline Enlargement	AECOM - GHD Joint Venture (2017)
35	Vibrancy Guideline Plan	AECOM - GHD Joint Venture (2017)
36	Resilience and Sustainability Guideline Enlargement	AECOM - GHD Joint Venture (2017)
37	Resilience and Sustainability Guideline Plan	AECOM - GHD Joint Venture (2017)
38	Typical Station Platform Section Pail Under	AECOM - GHD Joint Venture (2017)
39	Typical Overpass Section Rail Under	AECOM - GHD Joint Venture (2017)
40	Regional Planning Zones	AECOM - GHD Joint Venture (2017)
41	Regional Planning Overlays	AECOM - GHD Joint Venture (2017)
42	Proposed Pedestrian Circulation	AECOM - GHD Joint Venture (2017)
43	Proposed Cyclist Circulation	AECOM - GHD Joint Venture (2017)
44	Edithvale Road Proposed Road Layout	AECOM - GHD Joint Venture (2017)

WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

7.4 IMAGE SOURCES

#	IMAGE	REFERENCE
1	Edithvale - Seaford Wetlands	Frankston City Libraries (1866) Carrum Swamp in the County of Mornington map, Accessed October 13, 2017 < https://www.flickr.com/photos/39368267@N02/8743824436>
2	Edithvale Railway Station Opening	Museum Victoria (1920), Edithval Railway Station, circa 1920, Accessed October 13, 2017 <https://museumsvictoria.com.au/railways/image.aspx?PID=817>
3	Residential Growth	Victorian Places (2015), Future Farmland, Reclamation Scheme, Edithvale, 1954, Accessed October 13, 2017 < http://www.victorianplaces.com.au/category/headwords/edithvale>
4	Beach Development	Victorian Places (2015), Panorama at Edithvale, Accessed October 13, 2017 < http://www.victorianplaces.com.au/category/headwords/edithvale>
5	Edithvale Station Rebuilt	AECOM - GHD Joint Venture (2016)
6	Uniting Church in Australia Chelsea	Gary Sissons (2016), Unity Church's place of worship in Edithvale could be under the hammer soon due to maintenance costs, Accessed October 13, 2017 <http://baysidenews.com.au/2016/08/17/church-considers-church-sale/>
7	Beeson Reserve	Drew Echberg (2011), Beeson Reserve, Nepean Highway, Edithvale, Victoria, Accessed October 13, 2017 < http://www.urbaninitiatives.com.au/projects/pedestrian-space/beeson-reserve/>
8	Nepean Highway Neighbourhood Retail	AECOM - GHD Joint Venture (2016)
9	Nepean Highway to Beach Built form	Real Commercial (2015) 254-258 Nepean Highway, Edithvale, Accessed October 13, 2017 <http://www.realcommercial.com.au/property-land+development-vic-edithvale-501754906-photos.pdf?d64ab864d05d923a942f0d2617a0f57e-181.1220-24&type=photos&index=2&theme=rca.sold>
10	Edithvale Beach Bathing Boxes	Andy Vo (2013), Edithvale Beach 1 - HDR, Accessed October 13, 2017 <https://www.flickr.com/photos/voandy/9671112814/in/photostream/>
11	8-12 Lochiel Avenue Former Church	Google Streetview (2015), 8-12 Lochiel Avenue, Edithvale, Accessed October 13, 2017 < https://www.google.com.au/maps/@-38.0338656,145.107346,3a,75y,142.9h,95.62t/data=!3m6!1e1!3m4!1syEDhVV_tyhzjB3GPI4v0Yw!2e0!7i13312!8i6656>
12	Edithvale Road Level Crossing	Panoramio (2011), Railway Crossing by Edithvale Metro Station, Accessed October 13, 2017 <http://www.panoramio.com/photo/63833617>
13	Station Parking along Rail Corridor	Real Estate View (2017) 230 Station Street, Edithvale, Accessed October 13, 2017 <https://www.realestateview.com.au/real-estate/230-station-street-edithvale-vic/property-details-sold-residential-9507412/>
14	Edithvale Station Nepean Highway Access	AECOM - GHD Joint Venture (2016)
15	Edithvale-Seaford Wetlands	Walkabouters (2013), Braeside Park - Edithvale-Seaford Wetlands and return, Accessed October 13, 2017 <http://walkaboutersvic.blogspot.com.au/2013/09/>
16	Edithvale Beach	Mapio (2017), Edithvale Beach, Accessed October 13, 2017 <http://mapio.net/pic/p-43980447/>
17	Edithvale Station Platform	AECOM - GHD Joint Venture (2016)
18	Southbound Station Street Bus Stop Opposite Edithvale Station	AECOM - GHD Joint Venture (2016)
19	Edithvale Station access Station Street	AECOM - GHD Joint Venture (2016)
20	Northbound Station Street Bus Stop	AECOM - GHD Joint Venture (2016)
21	Station Street Rail Corridor Planting	AECOM - GHD Joint Venture (2016)
22	Edithvale Road Level Crossing Looking South	AECOM - GHD Joint Venture (2016)
23	Edithvale Station Nepean Highway Access	AECOM - GHD Joint Venture (2016)
24	Nepean Highway Residential Shopping Strip	AECOM - GHD Joint Venture (2016)
25	Beeson Reserve	AECOM - GHD Joint Venture (2016)
26	Pedestrian Level Crossing at Denman Avenue	AECOM - GHD Joint Venture (2016)
27	Rail Corridor Vegetation South of Edithvale Road	AECOM - GHD Joint Venture (2016)
28	Street Planters along Nepean Highway	AECOM - GHD Joint Venture (2016)
29	Edithvale Road Level Crossing Looking West	AECOM - GHD Joint Venture (2016)

7.5 TABLE SOURCES

#	TABLE	REFERENCE
1	Urban Design Considerations for Different Urban Contexts	AECOM - GHD Joint Venture (2017)

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APPENDIX B: URBAN CONTEXT CONSIDERATIONS

Table 1: Urban Design Considerations for Different Urban Contexts

URBAN DESIGN PRINCIPLES	1. IDENTITY	2. URBAN INTEGRATION	3. ACCESSIBILITY	4. CONNECTIVITY & WAYFINDING	5. SAFETY	6. AMENITY	7. VIBRANCY	8. RESILIENCE & SUSTAINABILITY
1. STATION PRECINCT	• Station built form design • Functional station design • Forecourt and entry • Public art and creative works • Landscape design • Heritage	• Station facility integration	• Suitable accessibility for all modes based on modal hierarchy • Equitable / universal access • Service and emergency access	• Station facilities (park'n'ride, kiss'n'ride, taxi access) • Intermodal connectivity • Bus interchange • Pedestrian and cycle routes • Vehicular access • Fences and barriers	• Safety in design requirements (CPTED) • Sight lines • Passive surveillance of station and station facilities	• Visual amenity – built form and landscape quality and character • User comfort (shelters, station access) • Station forecourt or plaza spaces. • Fences and barriers	• Station forecourt or plaza • Station facilities and non-transit land uses • Public art and creative works	• Sustainable built form and landscape design • Sustainability certification (green star rating) • Water sensitive urban design • Lighting design • Material durability and maintenance requirements • Vegetation loss and environmental impact
2. TRANSITION ZONE	• Interfaces with station precinct • Visual integration • Streetscape design • Public realm / public spaces • Built form character and heritage	• Development potential surrounding station • Urban renewal opportunities • Future proofing considerations • Integration between station and activity centre	• Pedestrian and cycle routes • Local road movements and impact on property and/or business access	• Development potential surrounding station • Urban renewal opportunities • Future proofing considerations • Integration between station and activity centre	• Visual connectivity and passive surveillance • Sight lines and safety in design for key movement routes	• Built form and landscape quality and character • Streetscape amenity • Fences and barriers	• Relationship with nearby activities / activity centre • Activation of spaces adjacent to station • Streetscapes	• Water sensitive urban design • Lighting design • Vegetation loss and environmental impact • Pollution mitigation
3. CORRIDOR AND THE WIDER PRECINCT	• Interfaces with corridor • Built form and corridor landscape character • Heritage	• Future road / rail network upgrades	• Access and connectivity within and across the corridor	• Future road/rail network upgrades	• Promote active transport and safe places	• Built form and corridor landscape character	• Key local activities and connectivity	• Natural heritage and biodiversity

(adapted from VicRoads Framework)

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APPENDIX C: STRATEGIC PLANNING BACKGROUND INFORMATION

CHARTER KECK CRAMER
Strategic Property Consulting

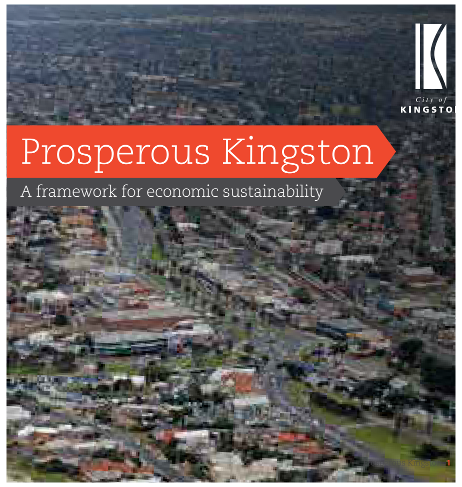
Retail / Commercial Development Strategy

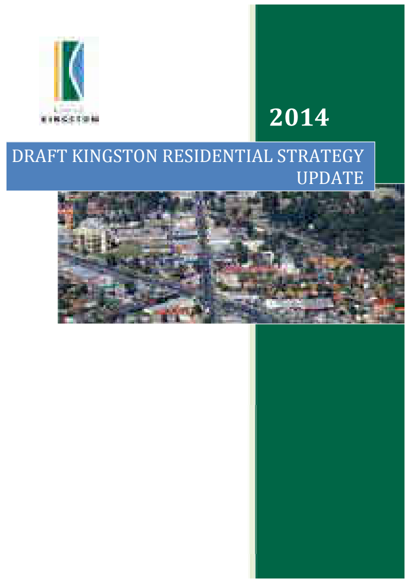
City of Kingston
In association with
Charter Keck Cramer and
Hansen Partnership

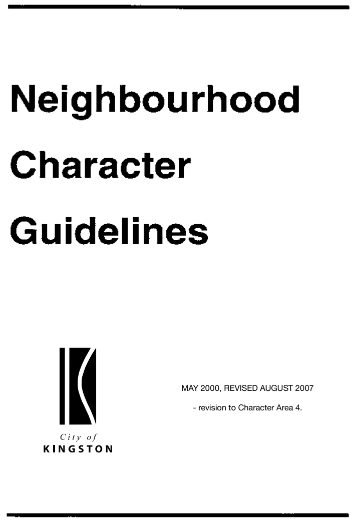
Final Report

Prepared for
City of Kingston

July, 2006

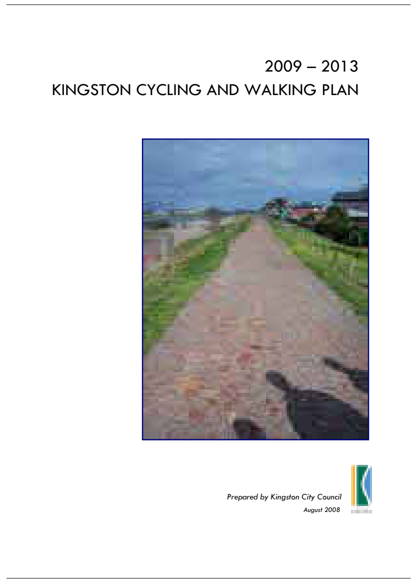

Prosperous Kingston
A framework for economic sustainability
City of KINGSTON


2014
DRAFT KINGSTON RESIDENTIAL STRATEGY UPDATE


Neighbourhood
Character
Guidelines

City of KINGSTON

MAY 2000, REVISED AUGUST 2007
– revision to Character Area 4.


2009 – 2013
KINGSTON CYCLING AND WALKING PLAN

Prepared by Kingston City Council
August 2008

TITLE	City of Kingston Retail/Commercial Development Strategy	Prosperous Kingston - A Framework for Economic Sustainability	Kingston Residential Strategy Update	Kingston Neighbourhood Character Guidelines	Kingston Cycling and Walking Plan
YEAR	2006		2014	2000, revised August 2007	2009
SUMMARY	This policy was developed to help guide future direction of retail, commercial and office investment in the City of Kingston. The policy identifies public transport access and quality as an important factor in commercial area development and that where possible, opportunities to increase public transport mode share should be maximised.	This policy recognises that the prosperity of the Kingston community is tied to the ability of the local economy to prosper and generate sustainable development. Access to a high quality integrated transport system that meets the needs of businesses and residents is seen as vital in maintaining and improving the economic prosperity of the municipality.	The policy is an update to the Kingston Residential Strategy 2000 which was prepared to address residential development within Kingston. The strategy proposes that there will be residential consolidation and increased densities within the Edithvale Neighbourhood Activity Centre, along major arterial roads such as Nepean Highway and close to public transportation (close to Edithvale Railway Station).	The Kingston Neighbourhood Character Guidelines identify different neighbourhood characters found within the diverse residential areas in Kingston and provide guidance for residential development relevant to the neighbourhood character of each area. The typical neighbourhood characteristics found in Landscape Character Areas relevant to the Edithvale Road, Edithvale level crossing are of one to two storey, detached dwellings which are orientated toward the street.	This policy recognises the importance of walking and cycling in Kingston and advocates for increased pedestrian and cycling infrastructure, including dedicated paths or lanes and improved signage in order to meet local needs and demands.
KEY SECTIONS	Whole document	Whole document	Planning Area Residential Frameworks within the strategy address residential land use issues at localised sites. The Edithvale Road, Edithvale level crossing is located within Planning Area 8 of this policy.	Whole document	Whole document

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Figure 40 - Regional Planning Zones

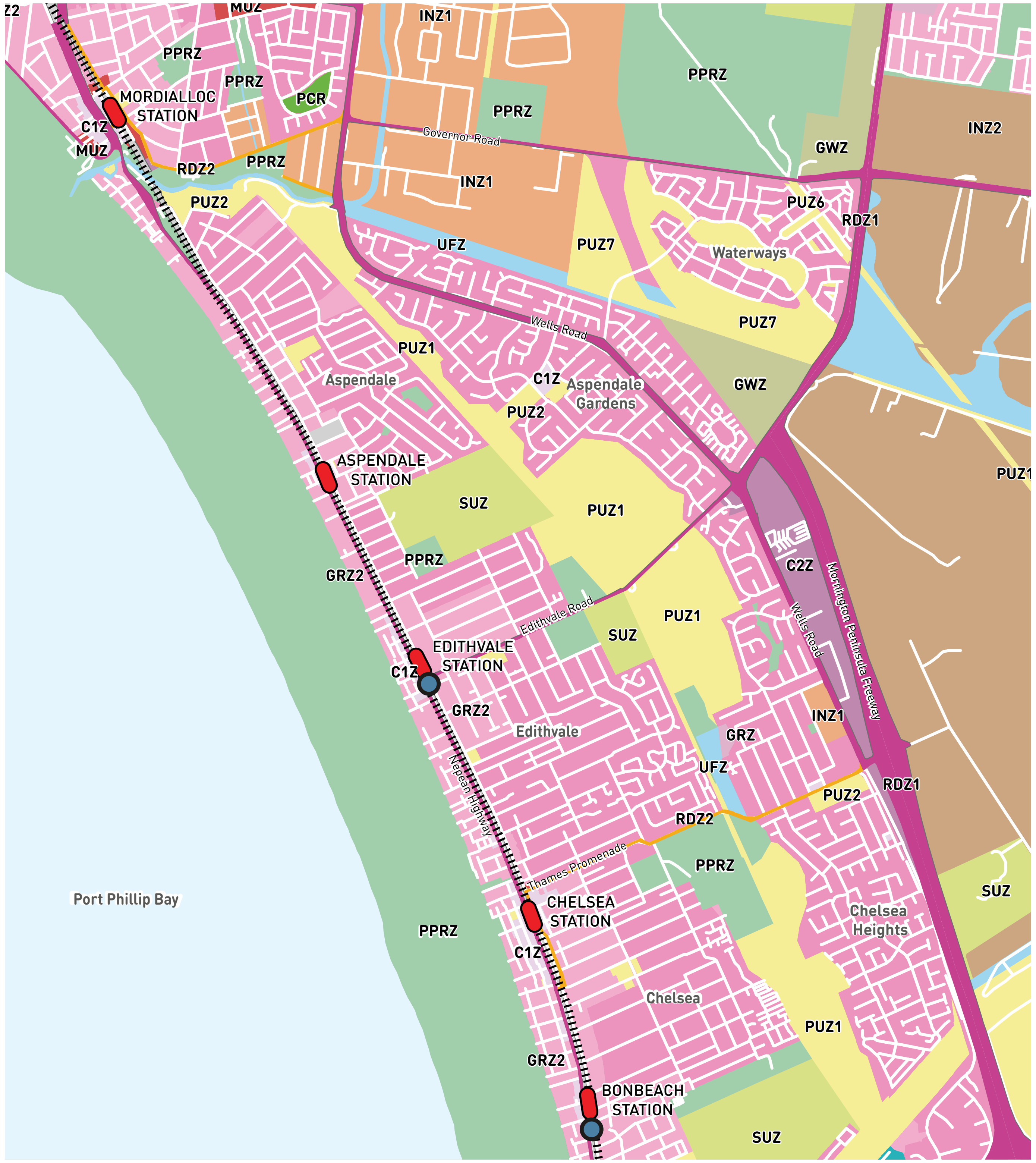
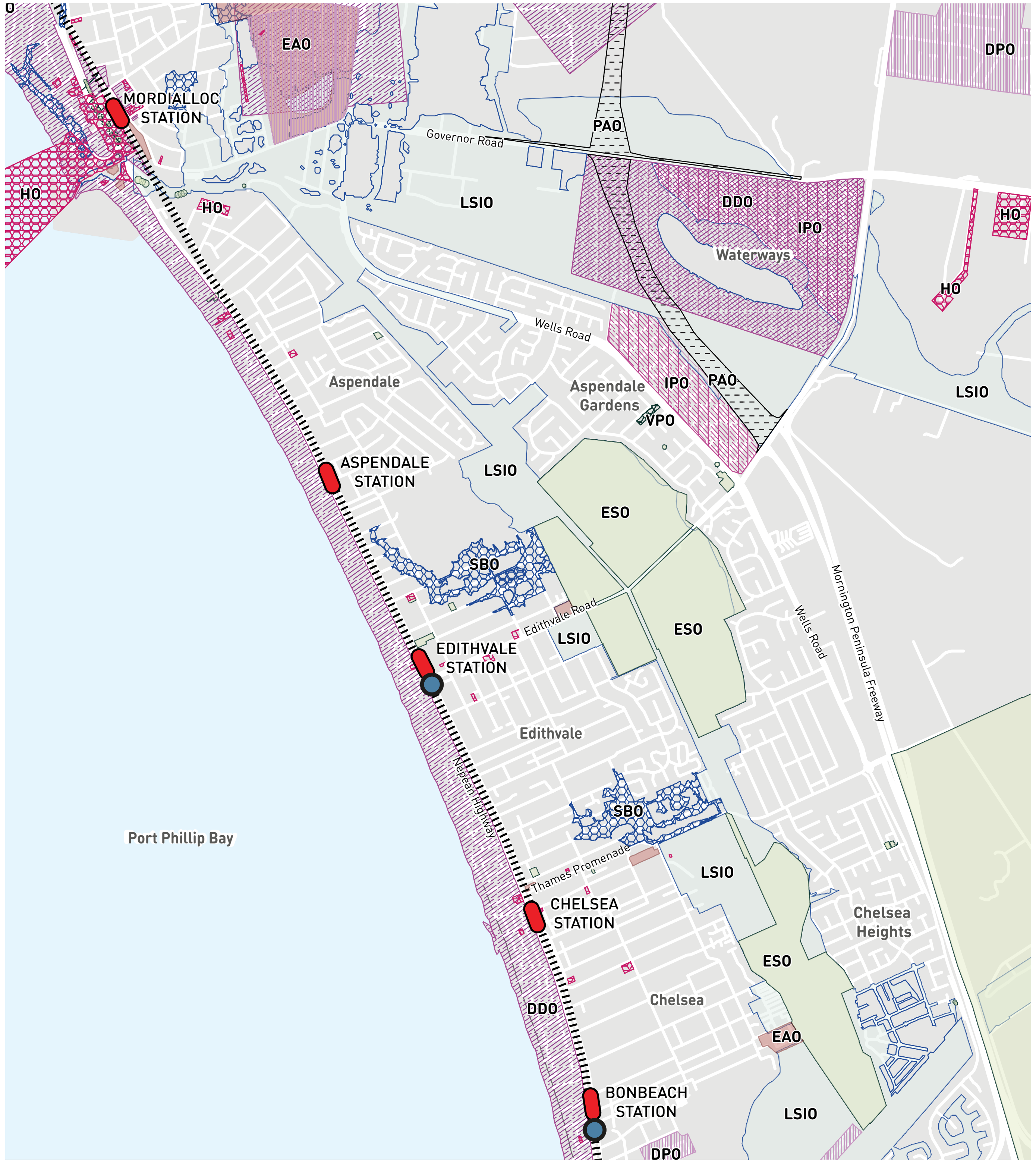


Figure 41 - Regional Planning Overlays



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LEVEL
CROSSING
REMOVAL
PROJECT

DELIVERING GREAT CHANGE

levelcrossings.vic.gov.au

AECOM GHD
JOINT VENTURE

VICTORIA
State
Government

LEVEL CROSSING
REMOVAL
PROJECT

LEVEL CROSSING REMOVAL AUTHORITY

STATION STREET/BONDI ROAD, BONBEACH

DRAFT

URBAN DESIGN GUIDELINES

27/02/2018

VERSION C

AECOM GHD
JOINT VENTURE

VICTORIA
State
Government

#	ROLES AND RESPONSIBILITIES		STATUS	DATE	NOTES
1	PROJECT DIRECTOR	A			
2	DIRECTOR - ENGINEERING AND PROGRAM SERVICES	C			
3	SENIOR PROJECT MANAGER (FOR SITE)	R			
4	UDAP WORKING GROUP	E			
5	MANAGER - TECHNICAL SERVICES	C			
6	PROGRAM WIDE PLANNING AND ENVIRONMENT SPECIALIST	C			
7	ACTIVE TRANSPORT - TRAFFIC ENGINEER	C			
8	DEVELOPMENT MANAGER	C			

Roles and Accountability

RACI MATRIX	
Responsible (R)	The individual(s) who perform(s) an activity - responsible for action / implementation.
Consulted (C)	The individual(s) to be consulted prior to a final decision or action being taken.
Endorse (E)	The individual(s) who need(s) to endorse key decisions, actions or deliverables.
Accountable (A)	The individual who is ultimately accountable, including yes/no authority and power of veto.
Informed (I)	The individual(s) who need(s) to be informed after a decision or action is taken.

Document Status

PMF Classification			
TRIM Folder	FOL/16/48141	Version	0
Issue date	27/02/2018	Status	Final
Owner	LXRA	Approver	

Version Control

Version	Date	Author	Title	Description of change
C	02/02/2018	JV	Draft Urban Design Guidelines	

Approval

Version	Issue date	Approved by	Title

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WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND
1.2 PROJECT SUMMARY
1.3 DOCUMENT PURPOSE
1.4 DOCUMENT STRUCTURE
1.5 METHODOLOGY
1.6 URBAN DESIGN FRAMEWORK

1. INTRODUCTION

1.1 PROJECT SUMMARY

By 2020, the Level Crossing Removal Authority (LXRA) will oversee the removal of 50 dangerous and congested level crossings across Melbourne and perform vital rail corridor upgrades, including rail extensions and duplication works (refer to Figure 1).

The Level Crossing Removal Program is designed to:

- Improve the reliability and efficiency of transportation networks, through reducing overall congestion;
- Enhance the urban amenity of local areas; and
- Create safer, better connected, liveable and thriving communities.

The LXRA was formed in May 2015 to oversee the delivery of the project and to ensure that level crossings are removed in a coordinated and efficient manner. LXRA's vision is *'delivering great change, by transforming the way Victorians live, work and travel'*. This vision is underpinned by 5 strategic objectives, including a commitment to creating great places.

LXRA and the AECOM-GHD Joint Venture (Technical Advisor), have led site investigations, functional and reference design packages, and the preparation of associated requirements and guidelines, to support the removal of level crossings at each nominated location. Stakeholder engagement and community consultation is an important part of this process, to ensure that stakeholder and community considerations are suitably addressed in the design and delivery of the project.

Further design development, construction and delivery works are now being delivered by LXRA through Program Alliance partnerships with leading industry specialists. Design and construction works for each site have been prioritised and staged to ensure that critical crossings are addressed as a priority and transport route delays and other impacts are minimised.

This project has the potential to set strong benchmarks and act as a catalyst for positive urban renewal that reinvigorates and reconnects communities. In order to create a lasting legacy, innovative and high quality urban design is key to the success of the project.

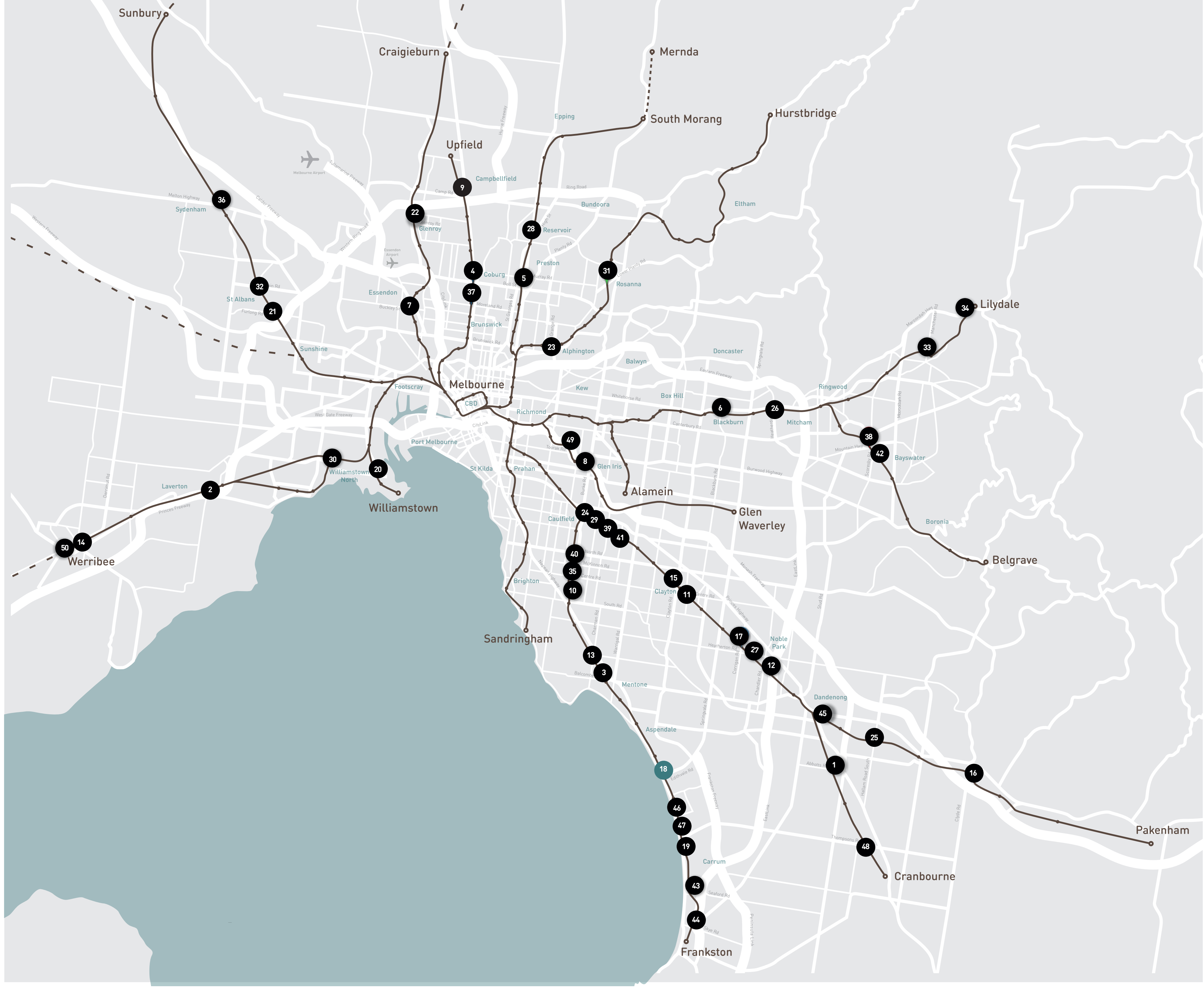

Figure 1: Level Crossing Removal - Project Map

ALTONA LOOP
30 Kororoit Creek Road, Williamstown North

BELGRAVE
38 Mountain Highway, Bayswater
42 Scoresby Road, Bayswater

CRAIGIEBURN
7 Buckley Street, Essendon
22 Glenroy Road, Glenroy

CRANBOURNE
1 Abbotts Road, Dandenong South
48 Thompsons Road, Lyndhurst

FRANKSTON
40 North Road, Ormond
3 Balcombe Road, Mentone
10 Centre Road, Bentleigh
13 Charman Road, Cheltenham
18 Edithvale Road, Edithvale
19 Eel Race Road, Carrum
35 McKinnon Road, McKinnon
43 Seaford Road, Seaford
44 Skye Road, Frankston
46 Station Street, Bonbeach
47 Station Street, Carrum

GLEN WAVERLEY
8 Burke Road, Glen Iris
49 Toorak Road, Kooyong

HURSTBRIDGE
23 Grange Road, Alphington
31 Lower Plenty Road, Rosanna

LILYDALE
6 Blackburn Road, Blackburn
26 Heatherdale Road, Ringwood
33 Manchester Road, Mooroolbark
34 Maroondah Highway, Lilydale

PAKENHAM
11 Centre Road, Clayton
15 Clayton Road, Clayton
29 Koornang Road, Carnegie
39 Murrumbeena Road, Murrumbeena
12 Chandler Road, Noble Park
17 Corrigan Road, Noble Park
24 Grange Road, Carnegie
27 Heatherton Road, Noble Park
41 Poath Road, Hughesdale
16 Clyde Road, Berwick
25 Hallam Road South, Hallam
45 South Gippsland Highway, Dandenong

SOUTH MORANG
5 Bell Street, Preston
28 High Street, Reservoir

SUNBURY
32 Main Road, St Albans
21 Furlong Road, St Albans
36 Melton Highway, Sydenham

UPFIELD
4 Bell Street, Coburg
9 Camp Road, Campbellfield
37 Moreland Road, Brunswick

WERRIBEE
2 Aviation Road, Laverton
14 Cherry Street, Werribee
50 Werribee Street, Werribee

WILLIAMSTOWN
20 Ferguson Street, Williamstown

*Not in priority order

Disclaimer: Sites are numbered for identification purposes only. Numbering does not indicate order of removal.

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1.2 SITE OVERVIEW

This Urban Design Guidelines Report has been prepared for the Station Street/Bondi Road Level Crossing Removal Project in Bonbeach.

The level crossing is located approximately 80 metres south of Bonbeach Station on the Frankston rail line. The station sits within the Bonbeach Neighbourhood Centre. The broader area is predominantly residential and within the vicinity of the Port Phillip Bay foreshore.

The boom gates at Station Street/Bondi Road level crossing are down for an average of 45 minutes during the weekday peak (between 7:00am and 9:00am), impacting travel times for approximately 4,400 motorists who travel over this crossing each day. The existing level crossing also poses a danger to pedestrians moving along and through Bondi Road.

The Station Street/Bondi Road Level Crossing Removal project will be delivered by the Southern Program Alliance.

1.3 DOCUMENT PURPOSE

The purpose of this Urban Design Guidelines (UDGs) document is to illustrate and describe the key urban design objectives and outcomes sought for the Station Street/Bondi Road Level Crossing Removal Project.

The Urban Design Guidelines have been prepared to build on the principles, objectives, measures and benchmarks of the LXRA Urban Design Framework (UDF). It outlines site specific urban design requirements the design is to achieve by:

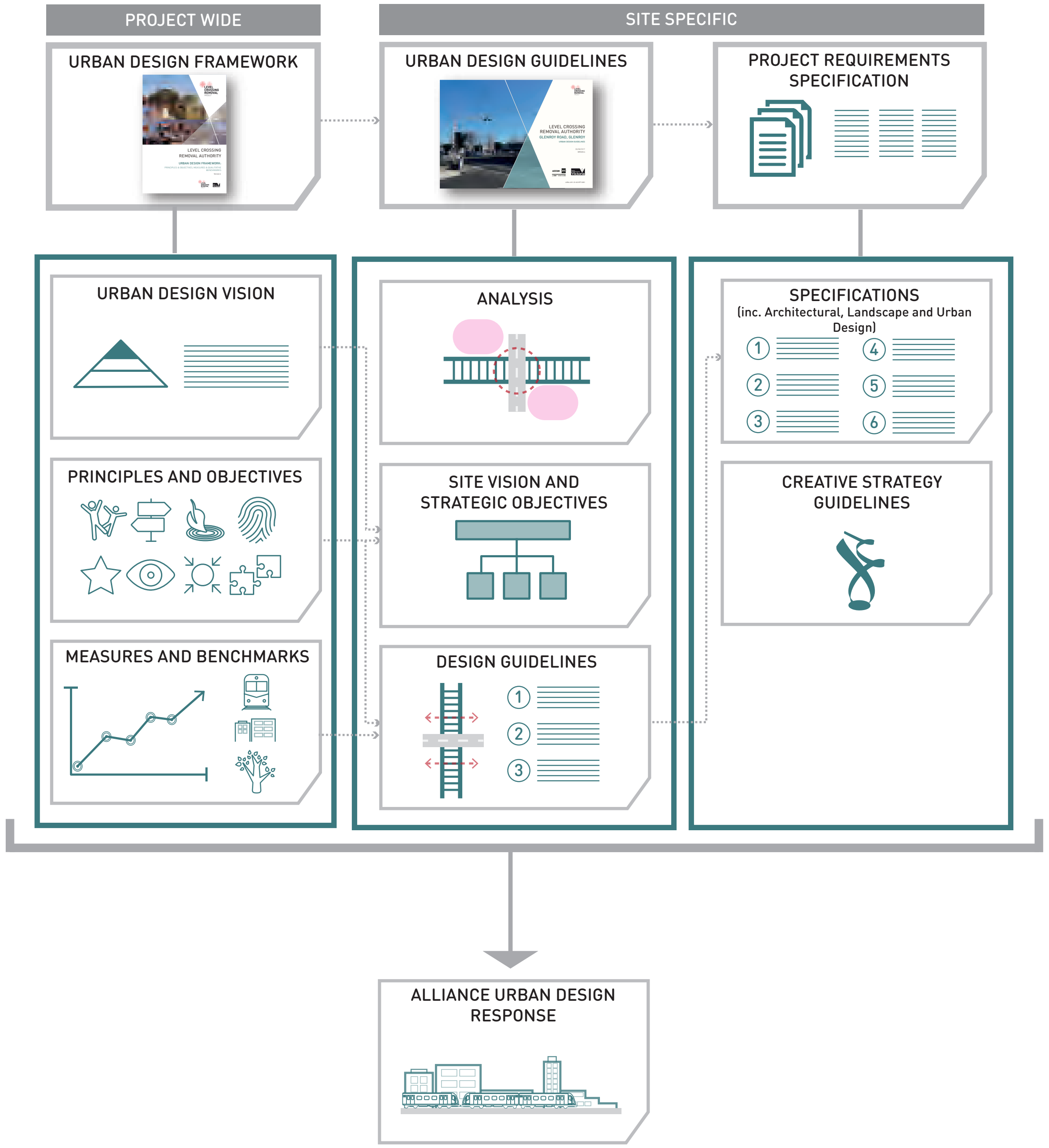
- Identifying key issues and opportunities for improving connectivity, amenity, functionality and place-making for the site and surrounding precinct;
- Articulating the broader urban design vision and strategic objectives for the site; and
- Establishing guidelines for the project, according to the urban design principles.

Further detailed urban design specifications also form part of the Project Requirements Specification (PRS).

The strategic objectives and guidelines set out by this document consider the management and mitigation of project risks that have been identified as part of the Environmental Effects Statement (EES) process for the Edithvale and Bonbeach sites. As such, the UDGs have been incorporated into the Environmental Performance Requirements (EPRs).

The analysis of policy and the existing context areas contained within this document should be read in conjunction with other relevant EES reports.

Figure 2: Urban Design Requirements


PROJECT WIDE
SITE SPECIFIC
URBAN DESIGN FRAMEWORK
URBAN DESIGN GUIDELINES
PROJECT REQUIREMENTS SPECIFICATION
URBAN DESIGN VISION
ANALYSIS
SPECIFICATIONS (inc. Architectural, Landscape and Urban Design)
PRINCIPLES AND OBJECTIVES
SITE VISION AND STRATEGIC OBJECTIVES
CREATIVE STRATEGY GUIDELINES
MEASURES AND BENCHMARKS
DESIGN GUIDELINES
ALLIANCE URBAN DESIGN RESPONSE

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1.4 DOCUMENT STRUCTURE

The Urban Design Guidelines document is structured in six (6) main parts, as outlined below:

SECTION 1: INTRODUCTION

Section 1 provides a summary of background information about the Level Crossing Removal Project and site.

SECTION 2: STRATEGIC PLANNING AND POLICY ANALYSIS

Section 2 identifies relevant state, local and project specific plans, policies and strategies, noting relevant implications for the site.

SECTION 3: CONTEXT ANALYSIS

Section 3 examines the existing site conditions, at a local and regional level and why this is important for the project.

SECTION 4: COMMUNITY AND STAKEHOLDER ENGAGEMENT

Section 4 presents the key considerations and themes that have emerged from stakeholder engagement and community consultation.

SECTION 5: ISSUES AND OPPORTUNITIES

Section 5 summarises issues and opportunities for the site and precinct, based on the preceding analysis and consultation outcomes.

SECTION 6: DESIGN GUIDELINES

Section 6 outlines the overall vision, strategic objectives and design guidelines for the project site which are site specific requirements that Alliance teams must address as part of their design response.

1.5 METHODOLOGY

The methodology and approach that has been taken in preparing the following guidelines, is illustrated in Figure 3.

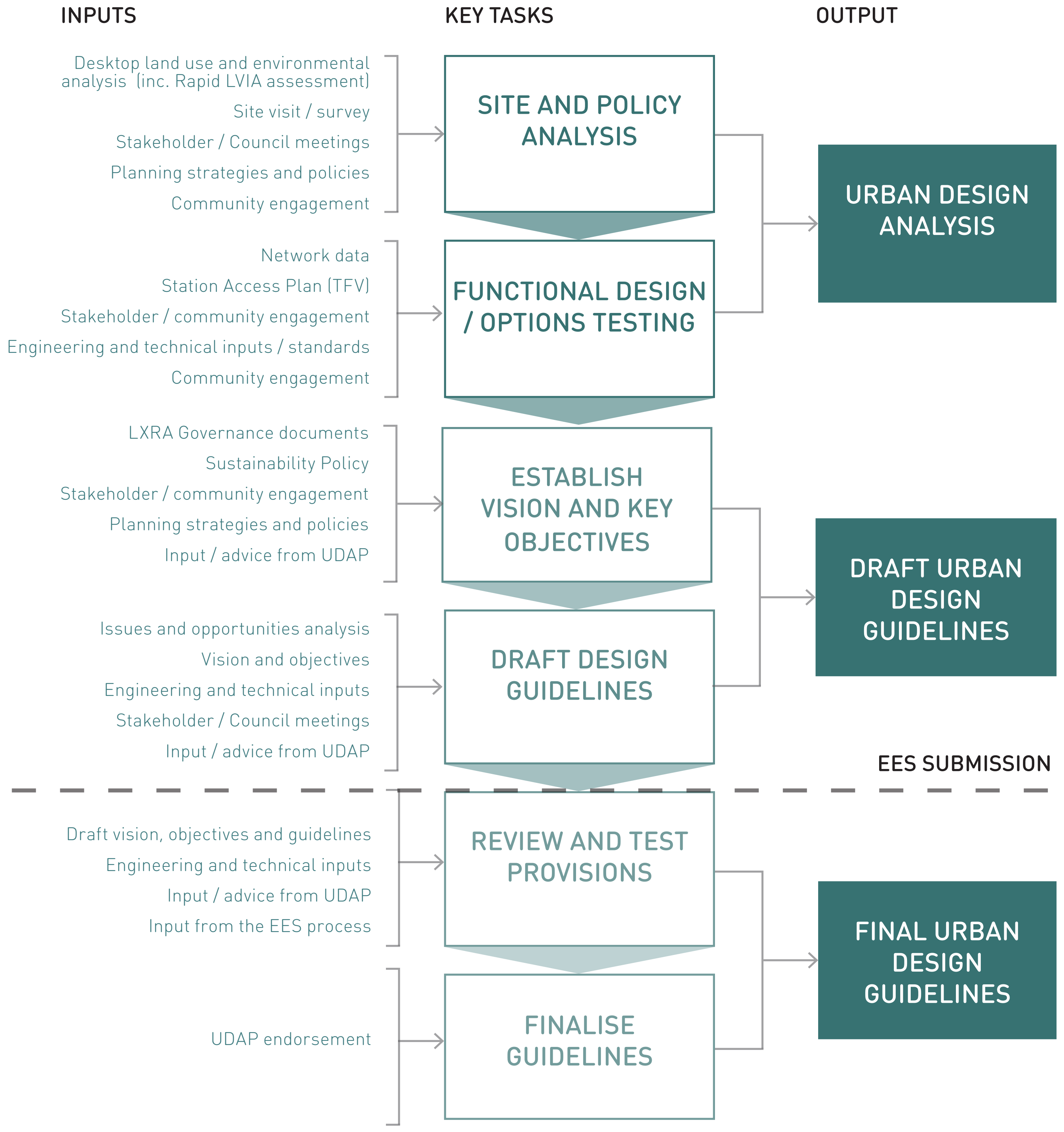
A number of workshops, technical inputs and data sources have been used to inform the guidelines, including:

- Urban Design Advisory Panel (UDAP) and working group sessions;
- Council and key stakeholder workshops;
- Landscape and visual impact assessment (LVIA)
- Civil and transport engineering inputs, including traffic and movement analysis;
- Rail and structural engineering advice;
- Ground engineering and geotechnical engineering;
- Planning and environmental analysis; and
- Advice in relation to utility engineering, fire life safety and building services. station

Periodic review and input from UDAP has been obtained throughout the development of the guidelines, to ensure the provisions satisfy the objectives and interests of the State.

This document has been prepared in conjunction with the LXRA Urban Design Advisory Panel (UDAP). UDAP comprises members from across government with specific professional expertise in architecture, urban design, strategic planning, transport planning and landscape architecture.

Figure 3: Methodology


INPUTS
KEY TASKS
OUTPUT
Desktop land use and environmental analysis (inc. Rapid LVIA assessment)
Site visit / survey
Stakeholder / Council meetings
Planning strategies and policies
Community engagement
SITE AND POLICY ANALYSIS
Network data
Station Access Plan (TFV)
Stakeholder / community engagement
Engineering and technical inputs / standards
Community engagement
FUNCTIONAL DESIGN / OPTIONS TESTING
URBAN DESIGN ANALYSIS
LXRA Governance documents
Sustainability Policy
Stakeholder / community engagement
Planning strategies and policies
Input / advice from UDAP
ESTABLISH VISION AND KEY OBJECTIVES
Issues and opportunities analysis
Vision and objectives
Engineering and technical inputs
Stakeholder / Council meetings
Input / advice from UDAP
DRAFT DESIGN GUIDELINES
DRAFT URBAN DESIGN GUIDELINES
EES SUBMISSION
Draft vision, objectives and guidelines
Engineering and technical inputs
Input / advice from UDAP
Input from the EES process
REVIEW AND TEST PROVISIONS
UDAP endorsement
FINALISE GUIDELINES
FINAL URBAN DESIGN GUIDELINES

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1.6 URBAN DESIGN FRAMEWORK

The LXRA Urban Design Framework outlines the expectations for achieving high quality, context sensitive urban design outcomes for each project. The document plays a dual role by informing the design process as well as providing a basis for the evaluation of design solutions.

The Framework identifies eight key principles inherent to successful major infrastructure projects (see Figure 4). Stemming from these principles are the urban design objectives which outline what the project should achieve in relation to the broader principles.

Performance measures and benchmarks are also identified in the Framework. They describe more specific requirements that the design must meet and include qualitative benchmark examples that illustrate the level of quality, materials and finishes that are expected.

The measures and benchmarks section of the Framework shall apply in addition to requirements set out in this guidelines document.

Principle 1
IDENTITY

A well defined identity and sense of place are key to creating strong and vibrant communities.

Principle 2
CONNECTIVITY & WAYFINDING

Well connected and legible places contribute significantly to strong economies and healthy, inclusive communities.

Principle 3
URBAN INTEGRATION

Well-integrated environments provide a sound framework for the successful development of great places.

Principle 4
RESILIENCE & SUSTAINABILITY

Places must be sustainable, enduring and resilient in order to support and nurture current and future generations.

Principle 5
AMENITY

High quality urban amenity associated with access to services and the experience of great public places contributes to successful, equitable and prosperous communities.

Principle 6
VIBRANCY

Animation of key civic spaces, and diversity in the experience of urban places support prosperous and healthy communities.

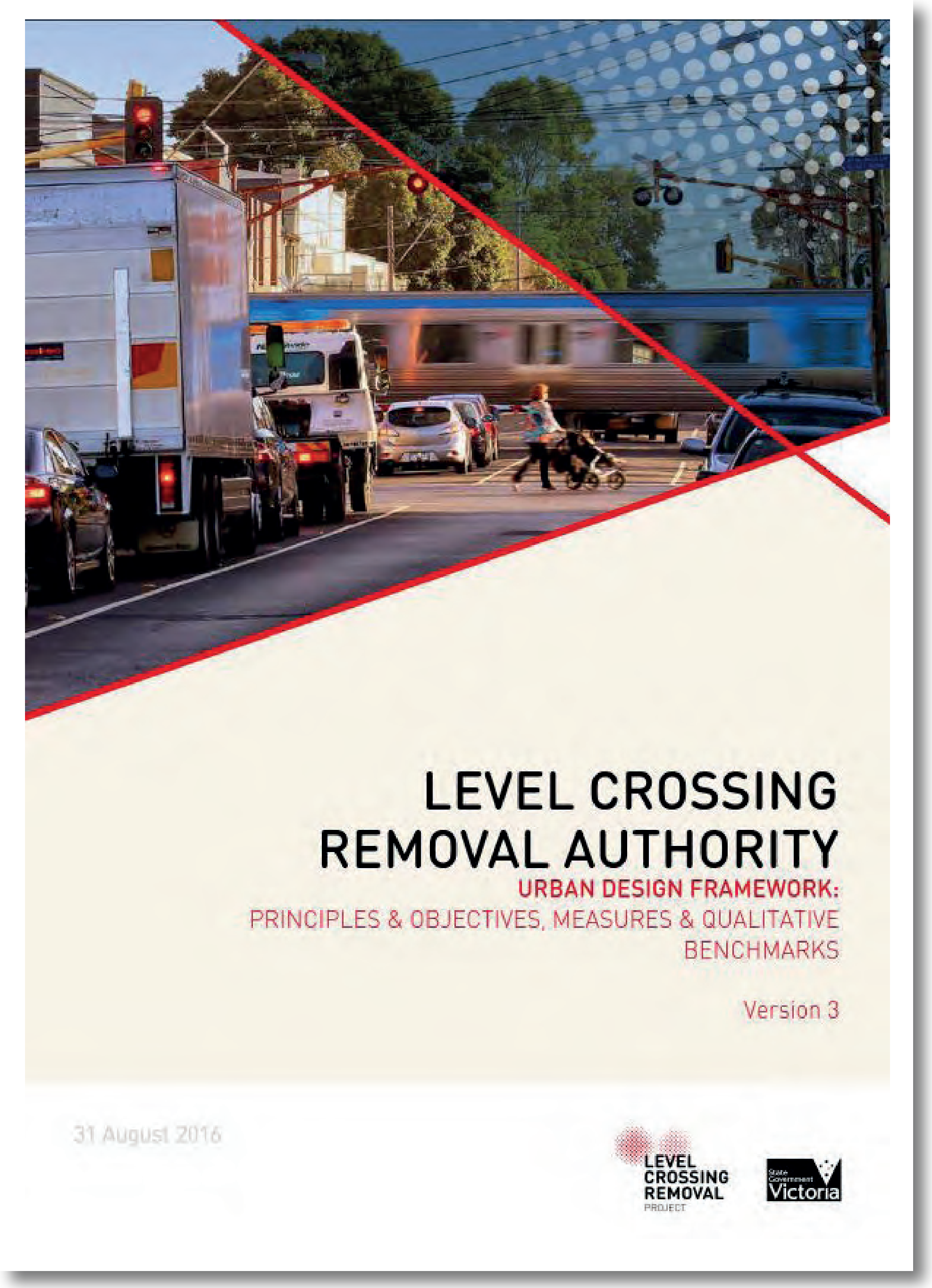
Principle 7
SAFETY

Safe environments are essential for strong, connected and happy communities

Principle 8
ACCESSIBILITY

Highly accessible and inclusive environments encourage positive activation and contribute to prosperity, well being and the perception of care within communities.

Figure 4: Urban Design Framework



LEVEL CROSSING
REMOVAL AUTHORITY
URBAN DESIGN FRAMEWORK:
PRINCIPLES & OBJECTIVES, MEASURES & QUALITATIVE BENCHMARKS

Version 3

31 August 2016

LEVEL CROSSING REMOVAL PROJECT

State Government Victoria

WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

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WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

2.0 CONTEXT ANALYSIS

2.1 REGIONAL CONTEXT

2.2 HISTORICAL CONTEXT

2.3 LOCAL CONTEXT

2.4 DEMOGRAPHICS

2.5 PHOTOGRAPHIC SURVEY

2. CONTEXT

2.1 GEOGRAPHIC CONTEXT

The Station Street/Bondi Road site sits within the City of Kingston, approximately 33 kilometres south-east of Melbourne's CBD along the Frankston Rail Corridor. Travel time via rail from Bonbeach Station is approximately 55 minutes to the city, and 12 minutes to Frankston Station. The rail corridor runs parallel to Nepean Highway from Mordialloc to Carrum, creating a barrier for east-west movement. A number of arterial roads intersect the corridor providing road access to surrounding residential areas, and key employment destinations via the Mornington Peninsula Freeway and Eastlink.

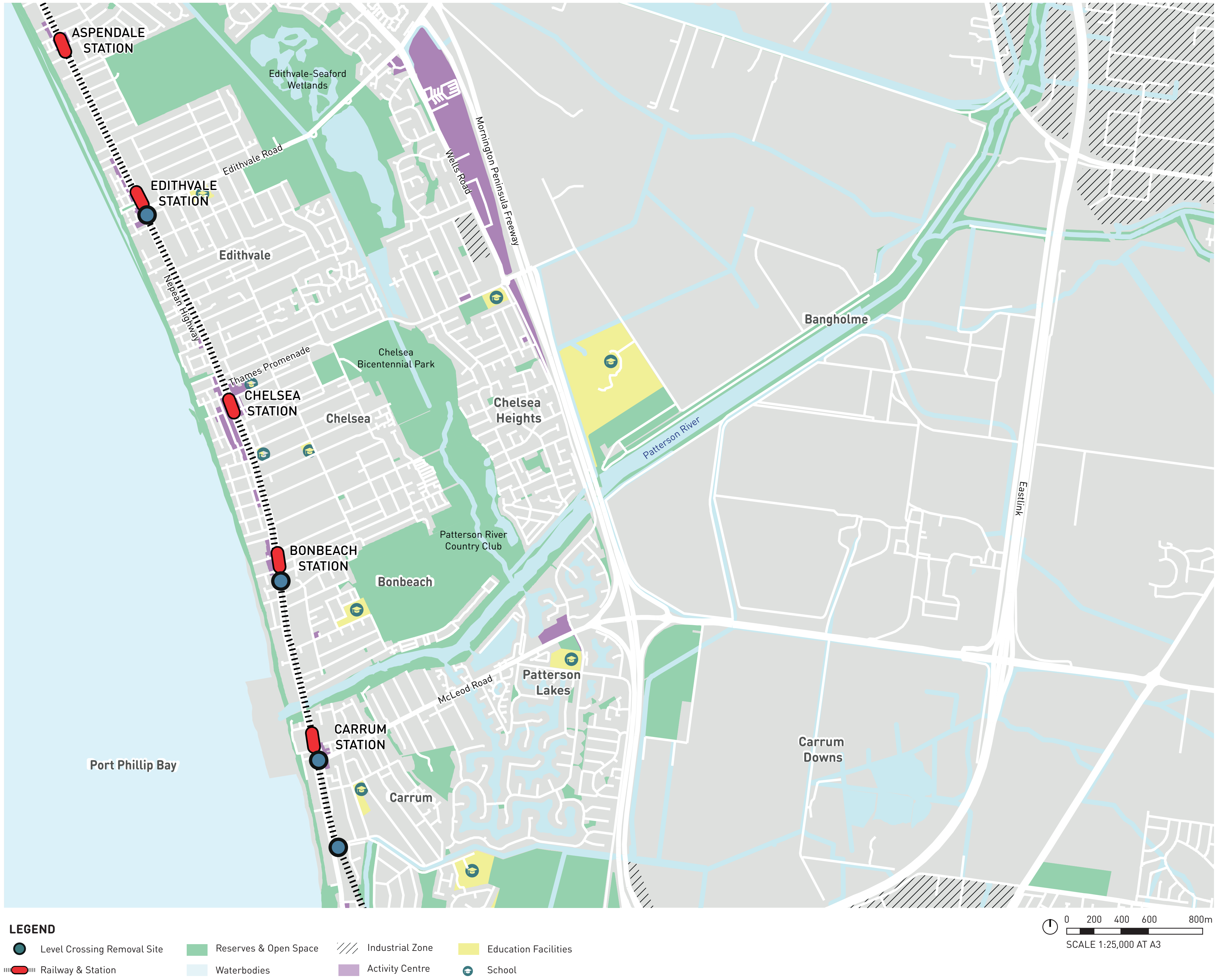
The Frankston Rail Corridor runs through an urbanised area with a mix of building types varying in height and setbacks. The area saw an increase in development during and after the Second World War. Buildings are typically of a suburban scale and style with recent infill redevelopment introducing sub-divided properties, town-houses, and small apartment buildings.

The southern end of the Frankston Rail Corridor predominantly comprises of residential housing and industrial estates. The Edithvale-Seaford Wetlands are located to the east of the rail corridor and are listed as internationally important. There are over 100 different species of birds regularly spotted in the wetland systems, including species of migratory birds from the northern hemisphere.

The corridor traverses a mix of open space amenities including parklands, narrow linear reserves, sport fields, playgrounds, and golf courses. Vegetation mitigates visual impacts and provides green links along most of the rail corridor contributing to the local landscape character. From Mordialloc, the rail corridor is located within close proximity to the coast line, where topography is flat and views to the beach are prominent. Shrubby, low lying coastal vegetation is predominant in the area.

The southern end of the Frankston Rail Corridor predominantly comprises of residential housing and industrial estates. The Edithvale-Seaford Wetlands are located to the east of the rail corridor and are listed as internationally important. There are over 100 different species of birds regularly spotted in the wetland systems, including species of migratory birds from the northern hemisphere.

Figure 5: Regional Context Map



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2.2 HISTORICAL CONTEXT

Figure 6: Historical Timeline

1879

PATTERSON RIVER CHANNEL

Artificial channel cut to release water from wetlands.

1926

BONBEACH RAILWAY STATION

Bonbeach station opened in 1926 to improve accessibility from Melbourne to the beach.

1938

PATTERSON RIVER BRIDGE

Collapsed wooden bridge replaced with a concrete bridge to improve northern commutes.

1950

RESIDENTIAL GROWTH

Population increase post WWII and subsequent opening of local schools.

1950

RECREATIONAL FACILITIES

Establishment of four ovals, golf course, and the Patterson River Country Club, providing a number of recreational facilites to locals and Melbourne residents.

2016

BONBEACH LEVEL CROSSING

Commencement of project to remove the level crossing at Bondi Road /Station Street and create a new station at Bonbeach.

The traditional owners and custodians of the land in and around Bonbeach are the Bunurong people, members of the Kulin Nation. Europeans began farming the area in the 19th century and displaced local inhabitants. The land was used by holiday-makers settling in tents or shacks, before gradually being occupied by more permanent residents.

From 1906 until the late 1940s sand was quarried on the east side of the railway line and used in the manufacture of glass. This land was sold in 1948 and developed into residential blocks, spreading Bonbeach's permanent population from the coastal strip across to the other side of the railway line.

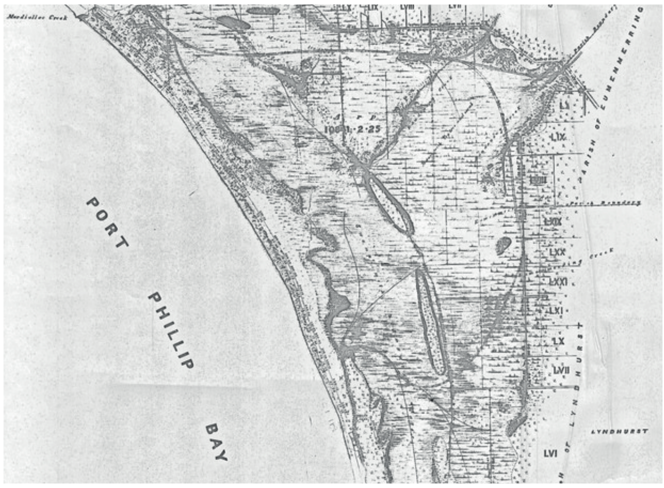

Image 1: Edithvale-Seaford Wetlands

Prior to European settlement in the 19th century the geography of the area consisted of large sand dune complexes on the coast, and wetland areas inland.

Image 2: Patterson River Artificial Channel

In 1879 a channel was created, later called Patterson RIver, cutting the Point Nepean Road to allow trapped water to escape from the swamp, marking the southern boundary of Bonbeach. A wooden passenger and rail bridge was constructed to connect north and south of the channel.

Image 3: Bonbeach Station

The station at Bonbeach opened in 1926, the last to be opened in the group from Aspendale to Carrum. The new station improved accessibility to the beach at Bonbeach, a popular destination for Melbourne beach-goers and people with holiday houses.

Image 4: Patterson River Bridge Upgrade

In 1938 a concrete bridge was constructed to replace the collapsed wooden bridge. This improved transport connections and removed the necessity to travel north via Dandenong.

Image 5: Residential Growth

The population in Bonbeach grew considerably post WWII leading to the opening of primary and high schools, as well as the expansion of the Patterson River Country Club and recreational facilities in the 1950s.

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2.3 LOCAL CONTEXT

LAND USE AND ACTIVITY

RESIDENTIAL

The land use immediately surrounding the Station Street/ Bondi Road level crossing site is predominantly residential land. Lots are generally 500-700 square metres in size, developed in the post war era (1960s).

There has been limited recent redevelopment and no significant intensification of housing in the area, which retains a predominantly low lying coastal residential character.

COMMERCIAL / MIXED USE

The Bonbeach Neighbourhood Centre sits in close proximity to the larger Chelsea Activity Centre to the north and the Carrum Activity Centre and the Frankston Metropolitan Activity Centre to the south. The Neighbourhood Centre is located along Nepean Highway with a few retail shops, comprising exclusively of small tenancies. Locals services and uses range from cafes, small shops, and personal and professional services, however many shop fronts are currently vacant.

Nepean Highway forms a continuous 'high street' environment for the small Neighbourhood Centre with active street frontages of retail shops and overhead canopies.

COMMUNITY FACILITIES

There are a number of community facilities located in the local area. Approximately 450 metres south of the station, along Station Street, is Bonbeach Residential Care and Nursing Home. There are two local schools south-east of the station, Bonbeach Primary and Bonbeach Pre-School. The Bonbeach Life Saving Club is a key community focal point, located approximately 300 metres south-west of the station, and includes a community room and cafe.

OPEN SPACE AND RECREATION

The level crossing site is located within close proximity to a suite of regional recreational destinations including the Port Phillip Foreshore and Patterson River Country Club (part of the Edithvale-Seaford Wetlands open spaces). The Bonbeach Sports Reserve is also in close proximity to the station and provides passive and formal sporting facilities. The area has few smaller, local level open spaces.

A number of beaches are within immediate walking distance of the station, to the west.

Image 6: Bonbeach Life Saving Club

Image 7: Existing Cafés and Retail on Nepean Highway

Image 8: Bonbeach Residential Care and Nursing Home

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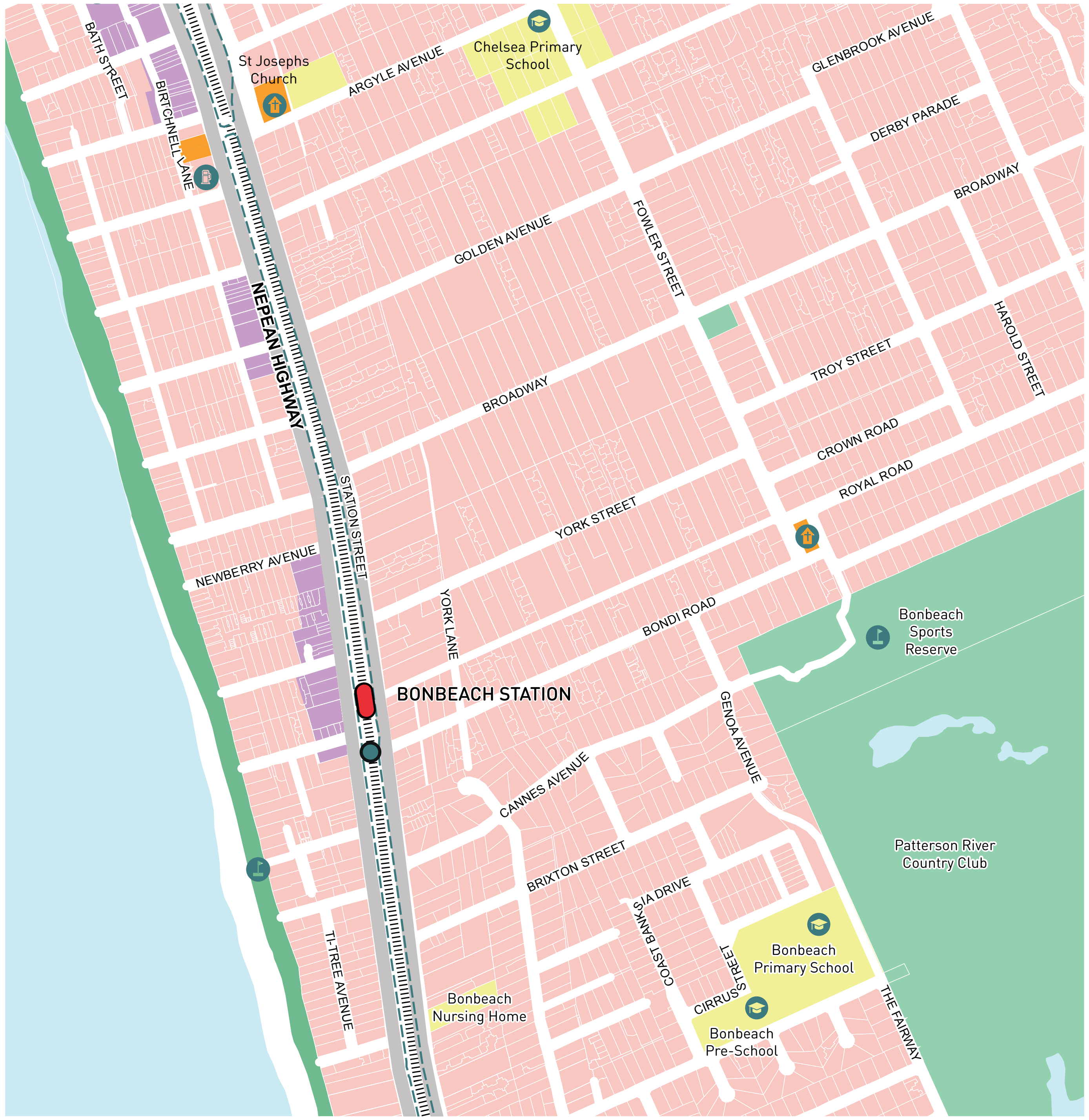
Figure 7 - Land Use Analysis Plan



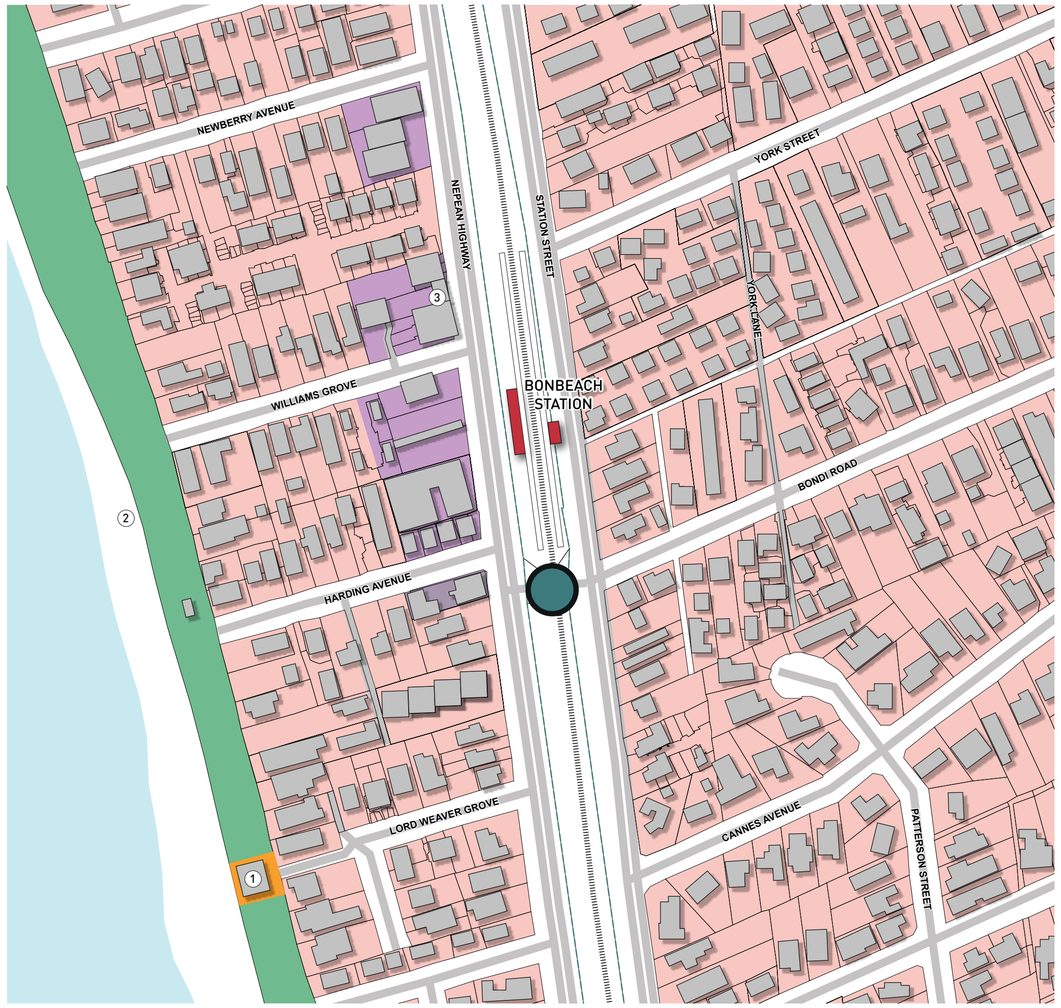
LEGEND

- ● Level Crossing Removal Site
- Railway & Station
- Victrack Boundary
- Major Roads
- Waterbodies
- Conservation Reserves
- Public Open Space & Recreation
- Community Uses - General
- Residential Area
- Neighbourhood Retail
- Education Facilities
- School
- Religious Facilities
- Sporting Facilities
- Petrol Station

0 40 80 160 240m

SCALE 1:8,000 AT A3

Figure 8 - Land Use Analysis Enlargement



LEGEND

- ● Level Crossing Removal Site
- Railway & Station
- Built Form
- Platform

SPECIFIC LAND USES

① Bonbeach Lifesaving Club
② Bonbeach Beach
③ Bonbeach Shopping Strip

0 20 40 90 120m

SCALE 1:4,000 AT A3

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BUILT FORM AND HERITAGE

BUILT FORM CHARACTER

Retail and commercial development is clustered to the west of Bonbeach Station along the Nepean Highway. Built form is generally single or double storey in height and built to the front boundary.

Existing zones and overlays maintain a maximum building height of two storeys between the railway line and the foreshore. The Kingston Planning Scheme does not specify a maximum building height for land east of the railway line. Nepean Highway and Station Street are predominantly one and two storey built form.

Residential housing predominately interfaces the rail corridor at Bonbeach. Constructed during the 1950s-1960s, dwellings are generally detached and single or double storey in height, even where redevelopment has occurred. Side and front built form setbacks create a well-landscaped coastal suburban character.

Residential interfaces with the railway are exclusively indirect (facing a street that interfaces with the railway line). Nepean Highway is lined with residential frontages that largely address the road with high front fences.

The existing Bonbeach Railway Station building is functional in form. While the station is a local landmark along the Nepean Highway, the building itself is not identified as being of architectural or historical significance.

Small boat sheds and bathing boxes, that have existed since the suburbs earliest days line the nearby beach. While modest in scale, and not directly adjacent to the rail corridor, they are an integral part of the neighbourhood identity.

HERITAGE

There are few sites of local heritage significance within Bonbeach. This includes a residential property at 3 Lord Weaver Grove, the clubhouse at Patterson River Country Club and a Primary School and St Joseph's Roman Catholic Church in Chelsea, north of the site.

It is noted that the above buildings and sites are protected by Heritage Overlays and are not listed on the Victorian Heritage Register.

ABORIGINAL CULTURAL HERITAGE

There are two extensive areas of cultural heritage sensitivity in Bonbeach. This includes coastal land within 200m of the high water mark, as well as the declared Ramsar Edithvale wetlands and 200m surrounds buffer area.

Image 9: 3 Lord Weaver Grove

Image 10: Patterson River Country Club

Image 11: Bonbeach Boat Sheds

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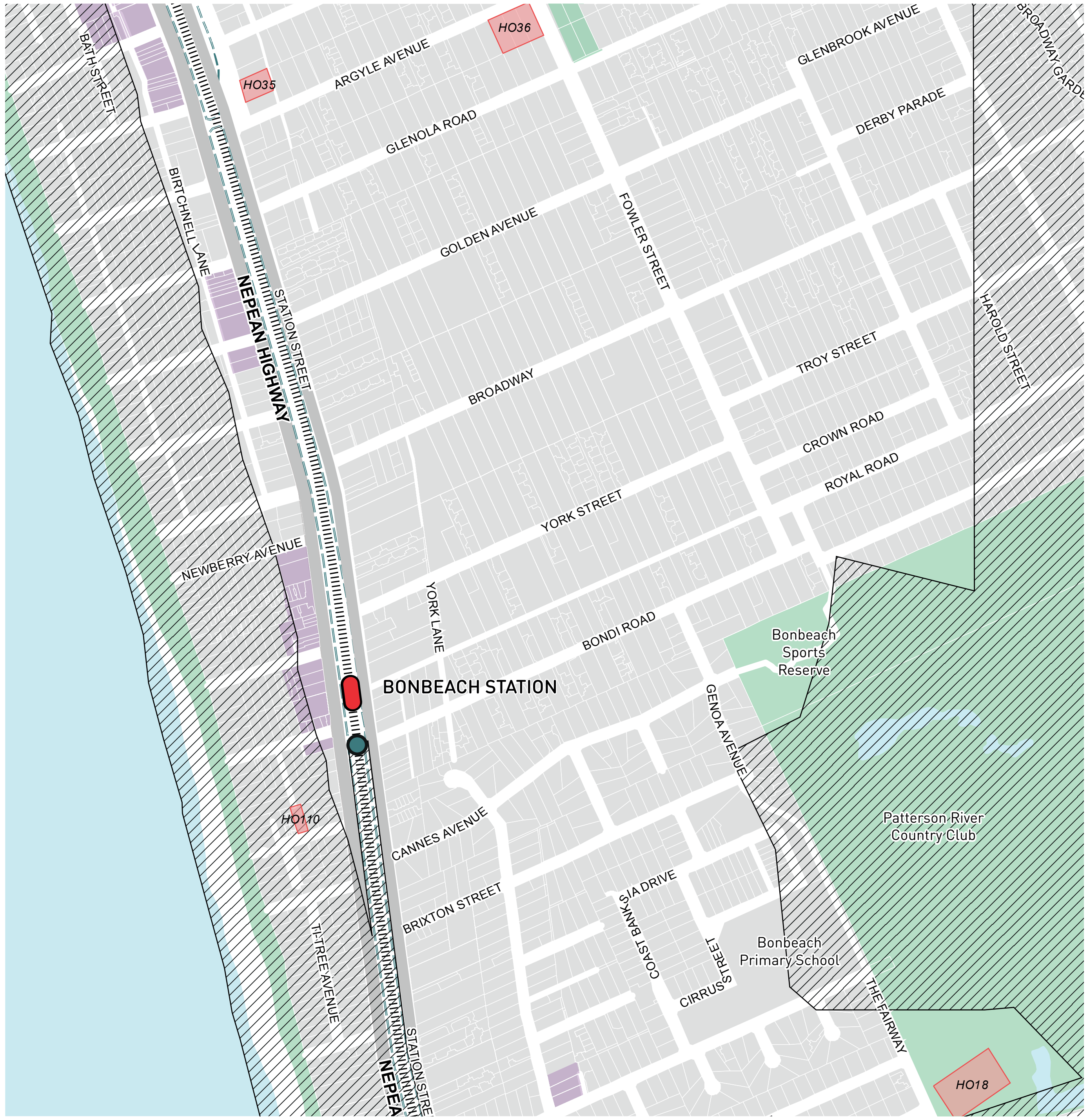
Figure 9 - Built Form and Heritage Analysis Plan

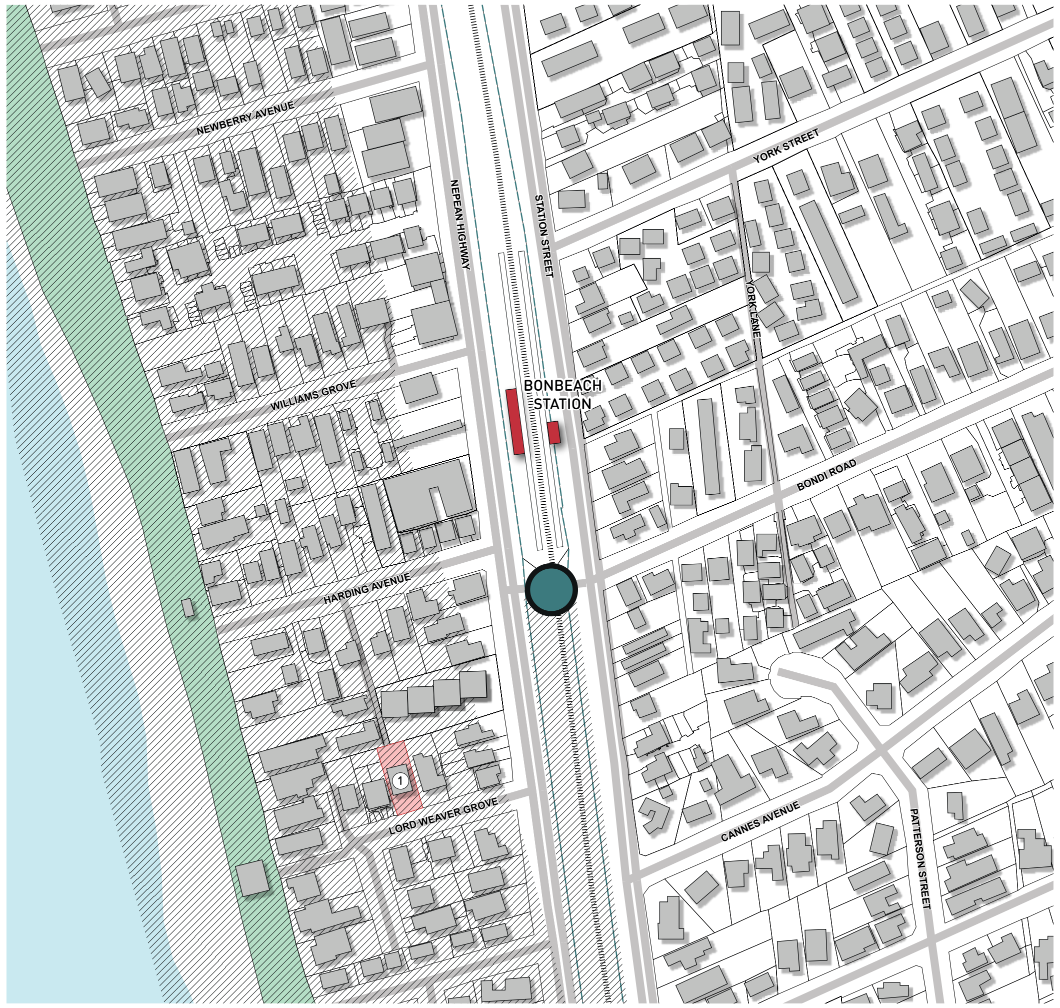


LEGEND

- ● Level Crossing Removal Site
- 🟥 Railway & Station
- – – Victrack Boundary
- ▬ Major Roads
- ▭ Waterbodies
- 🟩 Conservation Reserves
- 🟪 Local Activity Centre
- 🟥 Heritage Listed Sites
- ▨ Area of Cultural Heritage Sensitivity

0 40 80 160 240m
SCALE 1:8,000 AT A3

Figure 10 - Built Form and Heritage Analysis Enlargement



LEGEND

- ● Level Crossing Removal Site
- 🟥 Railway & Station
- ▭ Platform
- ▩ Low Scale Built Form (1-2 storeys)

SPECIFIC LAND USES

① House - 3 Lord Weaver Grove

0 20 40 90 120m
SCALE 1:4,000 AT A3

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TRANSPORT NETWORK AND ACCESS

STATION ACCESS

Bonbeach Station is an unstaffed station on the Frankston railway line and connects to Melbourne CBD and other activity, employment, and education centres, including Caulfield and Frankston. Services run at approximately 4-16 minute intervals during the AM peak period and at approximately 5-22 minute intervals during the PM peak period. Travel time from Bonbeach to the CBD is approximately 54 minutes.

In 2012, the average weekday patronage at Bonbeach Station was 1,162 passengers. Of these passengers 64.8% walk to the station, 34.2% travel by car, and 1.0% by bicycle.

BUS MOVEMENTS

Bonbeach Station has no connecting bus services; however, the 857 metropolitan bus service stops at the adjacent Chelsea Station and Carrum Station. There are single rail replacement bus stops (both north and south-bound) on Station Street.

VEHICULAR MOVEMENTS AND PARKING

Station Street is a major road with a single traffic lane running in each direction. It runs parallel to the Nepean Highway, north-south from Mordialloc to Carrum and provides a localised connection for cars, buses, and cyclists. It is bisected by Patterson River to the south. Bondi Road is a local traffic street that intersects west at Station Street and Nepean Highway.

The station currently accommodates 35 commuter car spaces to the east of the rail reserve. There are more informal car park spaces on the east and west side of the rail reserve on surrounding roads and streets. Car parking for the Neighbourhood Centre is on-road along Nepean Highway.

ACTIVE TRANSPORT

VicRoads' Principal Bicycle Network (PBN) is designated along Nepean Highway. The PBN connects the site to the Dandenong Creek Trail and runs alongside the Patterson River. Nepean Highway is used by cyclists even though there are no dedicated bicycle lanes.

Currently there is no dedicated Shared Use Path located within the rail corridor. Station Street has some painted on-road cycling/parking lanes and no dedicated cycling space is provided along Nepean Highway.

The rail corridor is bisected by a series of pedestrian crossings. These are located at The Glade and Broadway. Mernda Avenue also provides pedestrian and vehicle crossing access. These crossings are at grade with the railway line and are predominately aligned with existing beach access points.

There are existing pedestrian crossings associated with the Bondi Road, Nepean Highway and Station Street intersections on the north side only.

VicRoads designates Nepean Highway, between Newberry Avenue and Harding Avenue as a pedestrian priority route.

Image 12: Station Street/Bondi Road Level Crossing

Image 13: Existing Station Platforms

Image 14: Bonbeach Station Nepean Highway Access

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Figure 11 - Transport Networks and Access Analysis Plan

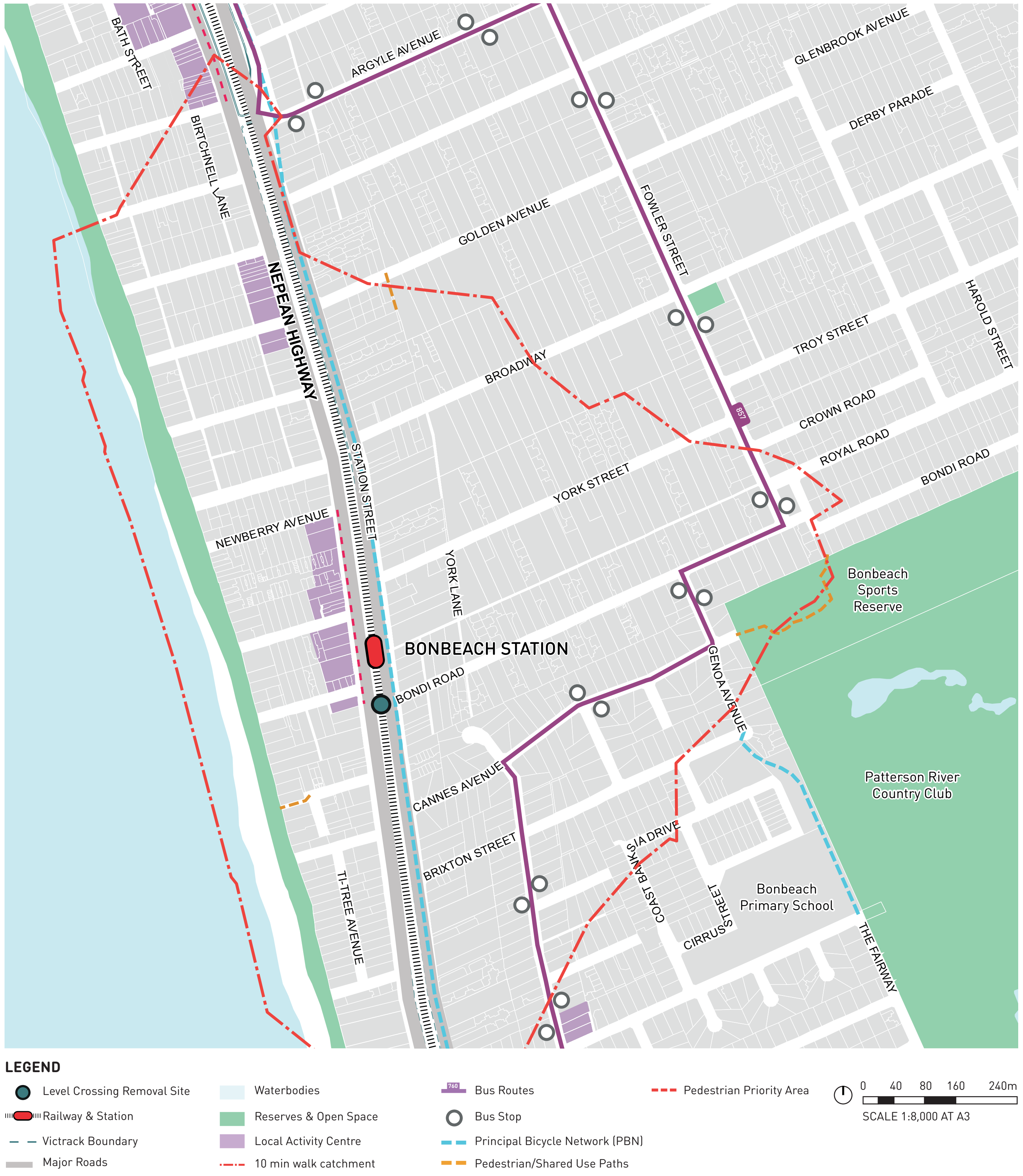
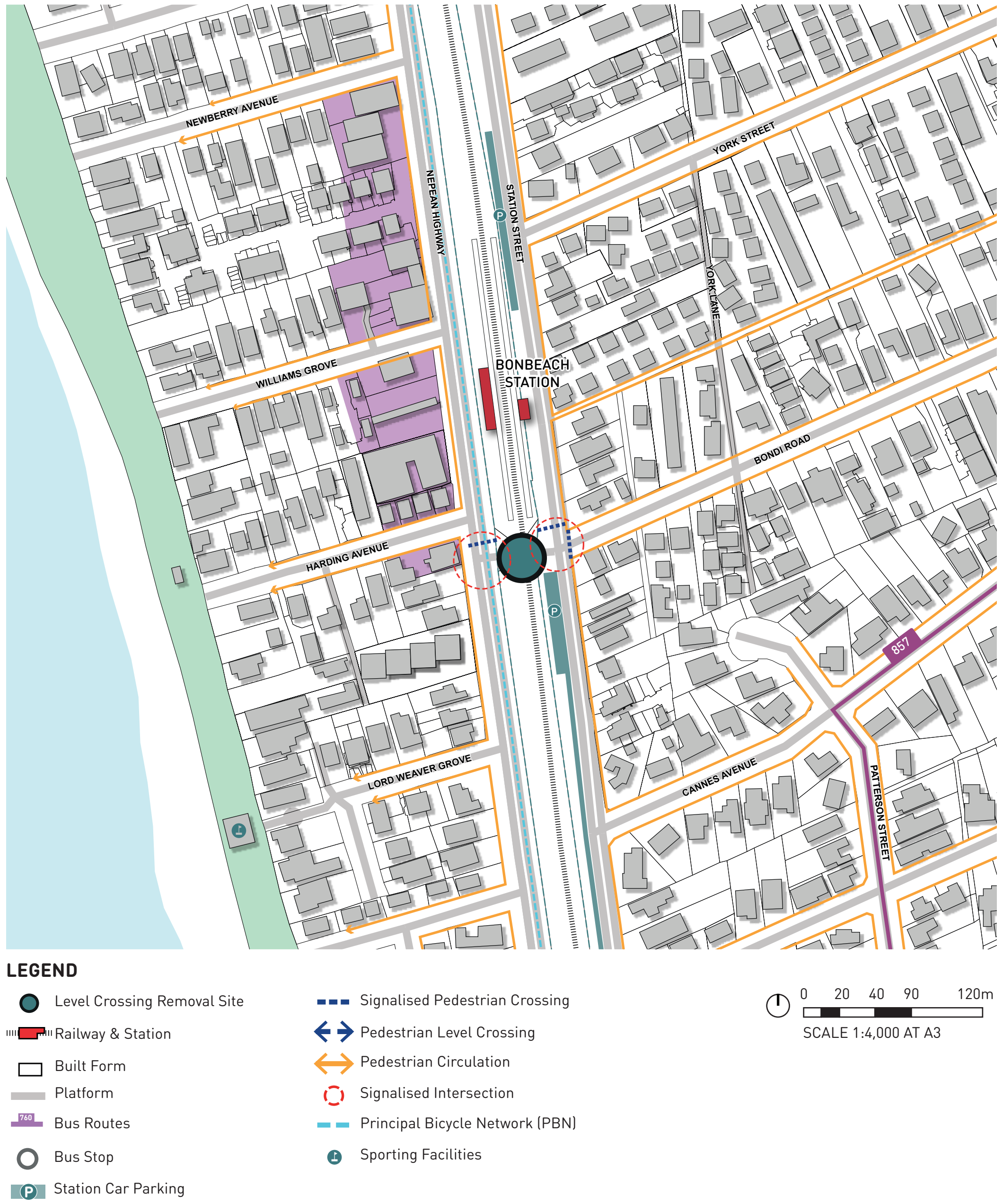


Figure 12 - Transport Networks and Access Analysis Enlargement



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LANDSCAPE AND PUBLIC REALM

GEOMORPHOLOGY

The geomorphology along the railway line at Station Street/ Bondi Road features Coastal Dune Deposits consisting of sand and silt. Dune blowouts are eroding a series of low unconsolidated ridges along the coast, remnant of a large barrier wetland complex. Drainage schemes and residential development have greatly modified the wetland and barrier terrain. This is the second largest barrier system in Victoria and is an important area for studies of dune, barrier and bar morphology and evolution.

TOPOGRAPHY

The topography is generally flat within the local area and along the rail corridor, which is characteristic of the coastal character of the area. Bonbeach Station sits 5 metres above sea level. The area gradually slopes down east and west of the rail corridor to Port Philip Bay.

LANDSCAPE CHARACTER

The project would have direct and permanent interactions with the low-lying coastal landscape, potentially emphasising the existing line of separation between the beach side western area and the main eastern area of Bonbeach. Vegetation entails a significant landscape value for the project area in that it reflects the broader low, endemic coastal landscape character associated with the Frankston rail line.

For a more detailed analysis of the landscape character of the site, refer to the Landscape and Visual Impact Assessment prepared as part of the EES.

OPEN SPACE NETWORK

Existing local public space is limited to the Bonbeach Sports Reserve which provides for some passive recreation opportunities and facilities for organised sport. Public space within the Bonbeach Neighbourhood Centre is limited to footpaths used by retail/commercial built form. Bonbeach Beach/Port Phillip Foreshore provides passive recreation opportunities for the local community and broader public.

There is no station forecourt at Bonbeach Station and there is limited circulation space around the station entry. Some landscaping is present along Nepean Highway.

NATURAL ENVIRONMENT

The rail corridor is intermittently planted with canopy tree vegetation and under-storey planting, screening views of the corridor from residential and retail/commercial interfaces. The streetscape of the local area has limited canopy vegetation.

Located within the Gippsland Plains Bioregion, established planting and vegetation along nature strips and within the railway corridor provides a green buffer to adjacent residential streets.

There is no ecological vegetation system at the Station Street/Bondi Road, Bonbeach level crossing site. Within the local area, Coastal Dune Scrub can be found predominantly along the foreshore of Bonbeach. The Patterson River Country Club contains Plains Grassy Wetland and Damp Sands Herb-rich Woodland vegetation provide open-grassland/herbland of up to 1m in height along the rail corridor to the north and south.

The Edithvale-Seaford Wetlands are located to the east of the rail corridor. Listed as a Wetland of International Importance under the Ramsar Convention, it is recognised as an important natural habitat for a range of flora and fauna species. This includes over 190 bird species and 14 plant communities, with many of these being of State and regional significance.

Coastal Dune Scrub is predominant along the foreshore of Bonbeach Beach. This indicates deep, uniform textured siliceous and calcareous sands subject to high levels of saltspray, wave action and disturbance from onshore winds, with a structure that is comprised of scrub up to 5 metres in height. Coast Banksia Woodland, also listed as vulnerable, can be found throughout the Edithvale-Seaford Wetlands.

Image 15: Patterson River Country Club Golf Course

Image 16: Edithvale - Seaford Wetlands

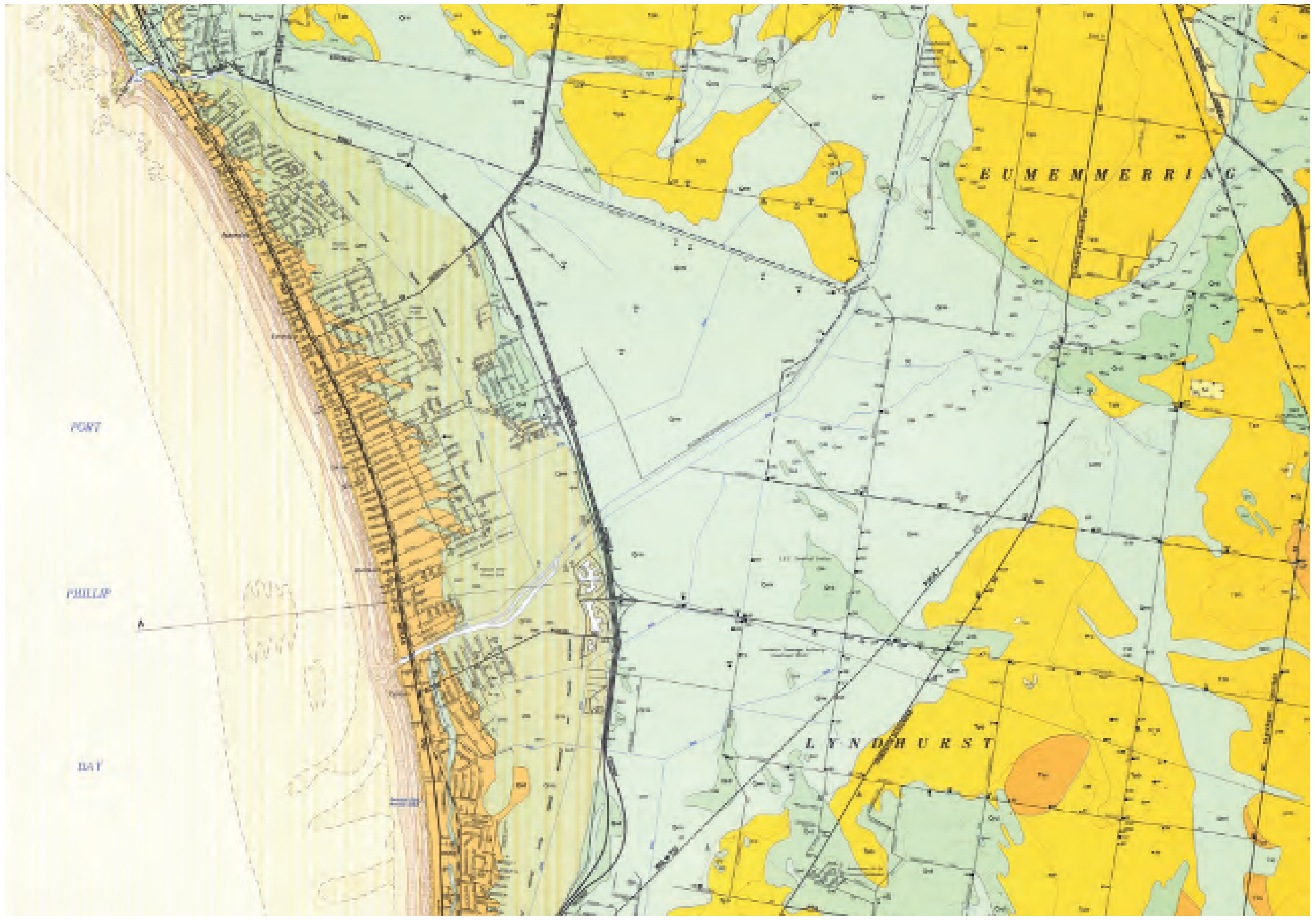

Figure 13: Geomorphological map of area

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Figure 14 - Landscape and Public Realm Analysis Plan

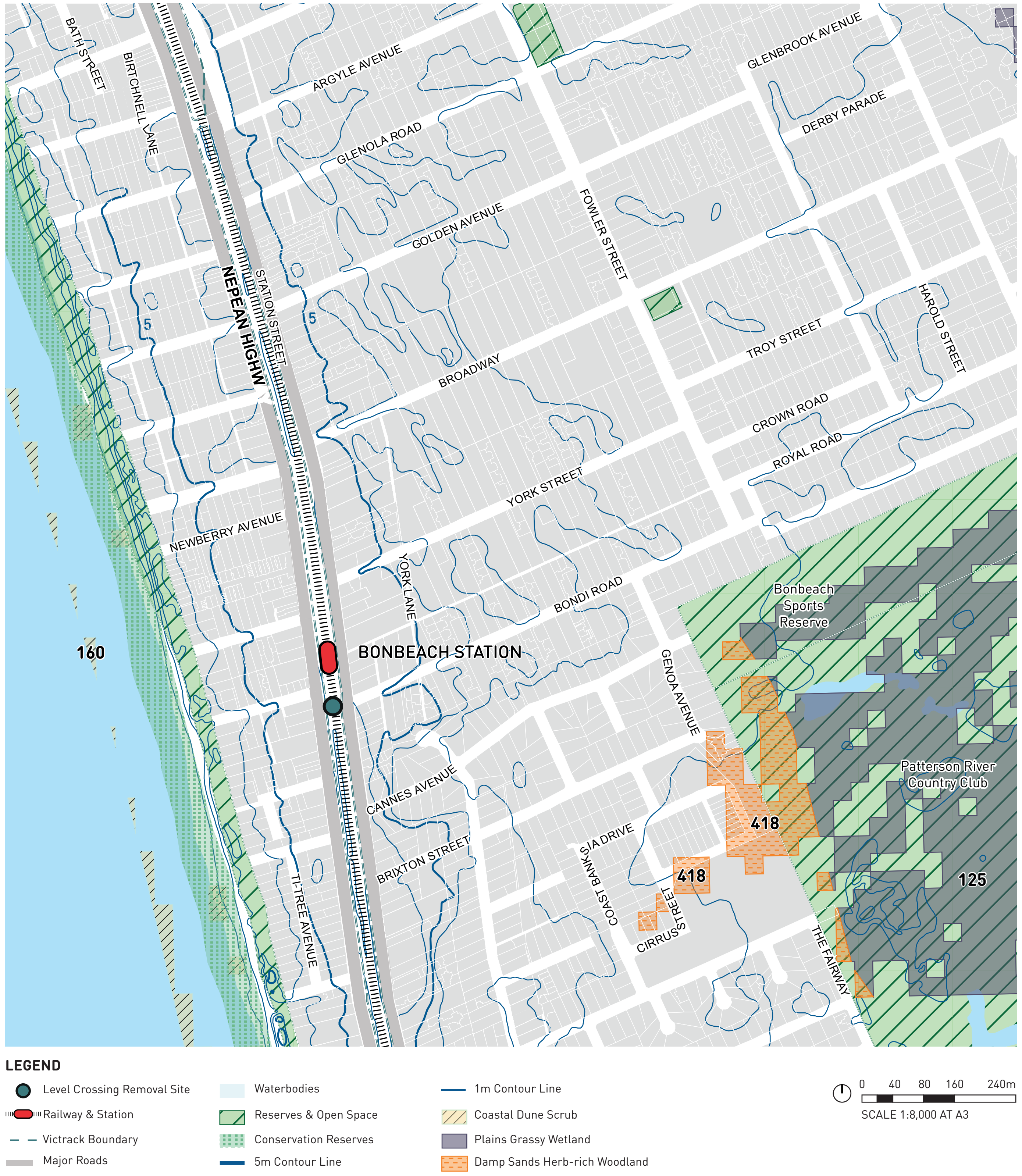
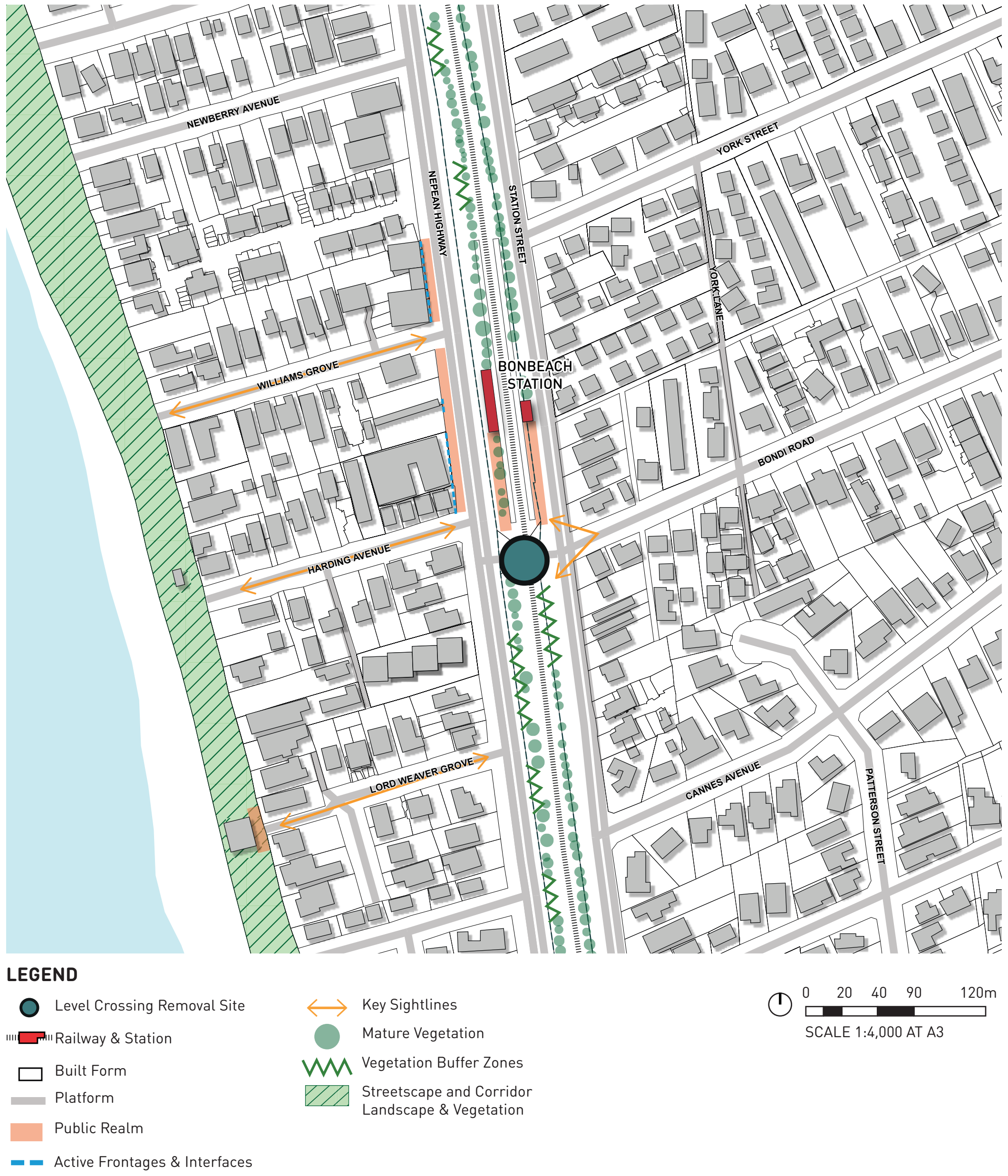


Figure 15 - Landscape and Public Realm Enlargement



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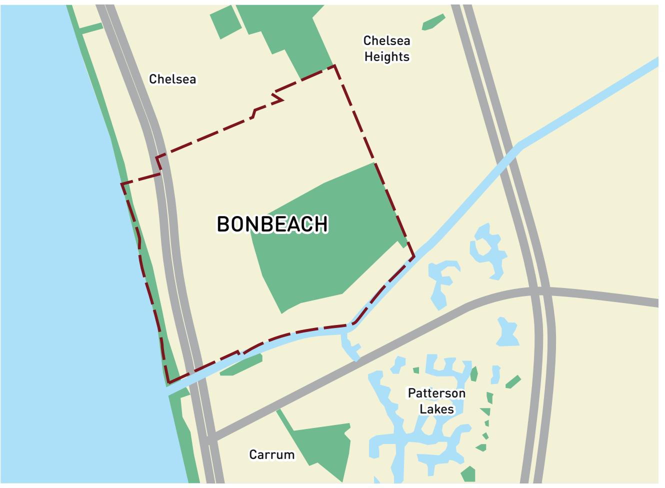
2.4 DEMOGRAPHICS

Figure 16 - Key Map - Bonbeach Statistical Area



The following infographics represent a summary of the demographic characteristics for the Bonbeach Statistical Area (SSC20277). The data has been derived from the 2011 and 2016 Australian Bureau of Statistic, Quick Stats and future population forecast data from the City of Kingston Profile id.

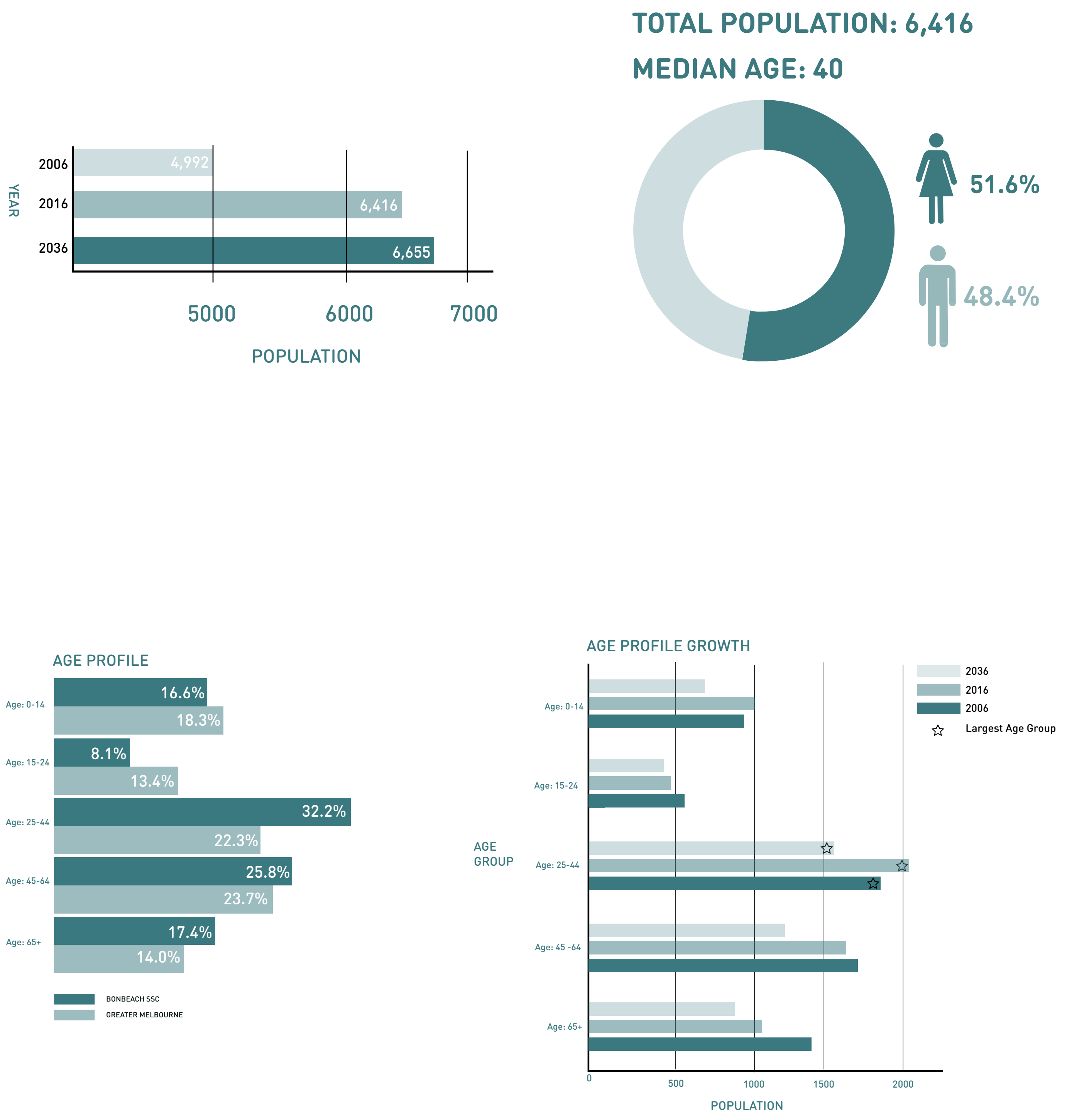
POPULATION PROFILE

At the time of the 2016 Census, Bonbeach had a population of 6,416 people. The area has recorded a consistent increase in population from 2006 to 2016. While the area is predicted to continue growing up to and past 2036, the rate of growth is lower than present.

In 2016, the population had a relatively even proportion between male (48.4%) and females (51.6%). The median age was 40, corresponding to the largest age group of 25 - 44 year olds. In comparison to Greater Melbourne, Bonbeach has a smaller portion of younger populations within the 0 - 14 and 15 - 24 year old age groups. Other age groups are larger than Greater Melbourne, with the biggest difference occurring in the 25 - 44 year old age group of 9.9%. Suggesting that Bonbeach has a slightly higher proportion of older individuals than is seen throughout Melbourne.

Between 2006 and 2016 all age cohorts increased at a relatively similar rate. However, the 0 - 14 and 25 - 44 year old age groups are predicted to represent a lower prop future population estimates in 2036. All other age groups are slowly increasing in relative share, with a larger jump in population above 65 years old from 2016 to 2036.

Figure 17 - Population Profile and Growth Projections



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DWELLING CHARACTERISTICS

A high percentage of private dwellings within the Bonbeach Statistical Area are occupied (90.7%). The number of dwellings has increased by 335 from 2006 to 2016. While dwelling growth is predicted to increase by 2036, the rate is much lower with only 304 new dwellings over the 20 year period.

Of the occupied private dwellings within Bonbeach, 37.4% of dwelling structure were separate houses, 148.3% were semi-detached terrace houses or town-houses, and 8.3% we flats, units or apartments, with 5.7% classified as other dwellings. This has shown a significant change in dwelling types with dense low storey built form increasing. The volume of separate houses from 2011 decreased by 12.6% (from 50.0%) and flats, units or apartments decreased by 13.6% (from 21.9%), while semi-detached, terrace or town-houses saw a considerable increase of 26.7% (from 21.6%).

The dwelling profile of Bonbeach differs from Greater Melbourne, with semi-detached, terrace, or town-houses having the largest volume. In comparison to Greater Melbourne, Bonbeach has smaller differentiations between volumes of dwelling profiles. Bonbeach has a smaller distribution of separate houses. Within Greater Melbourne the volume of semi-detached terrace or town-house, and flat, unit, or apartments are much closer at 16.8% and 14.7% respectively.

Figure 18 - Dwelling Profile and Growth Projections

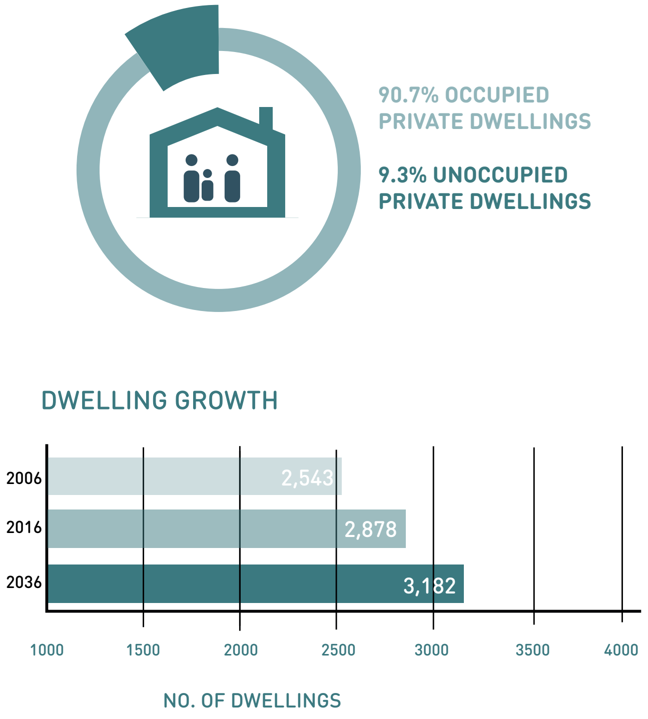
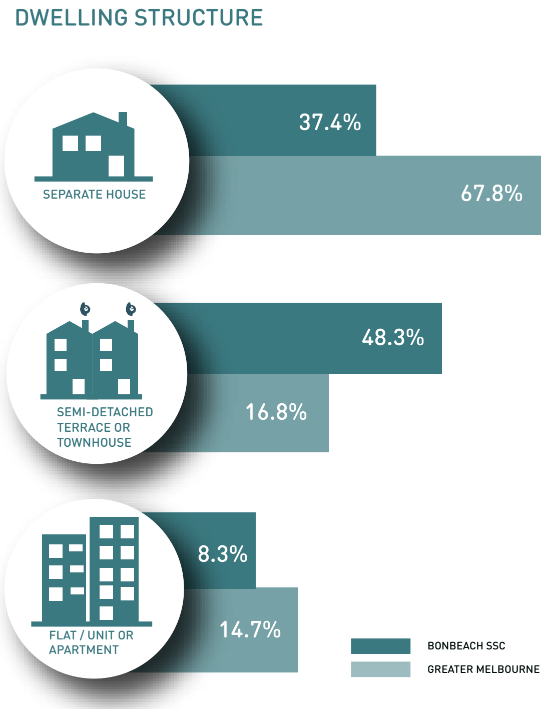


Figure 19 - Dwelling Profile Comparative Analysis

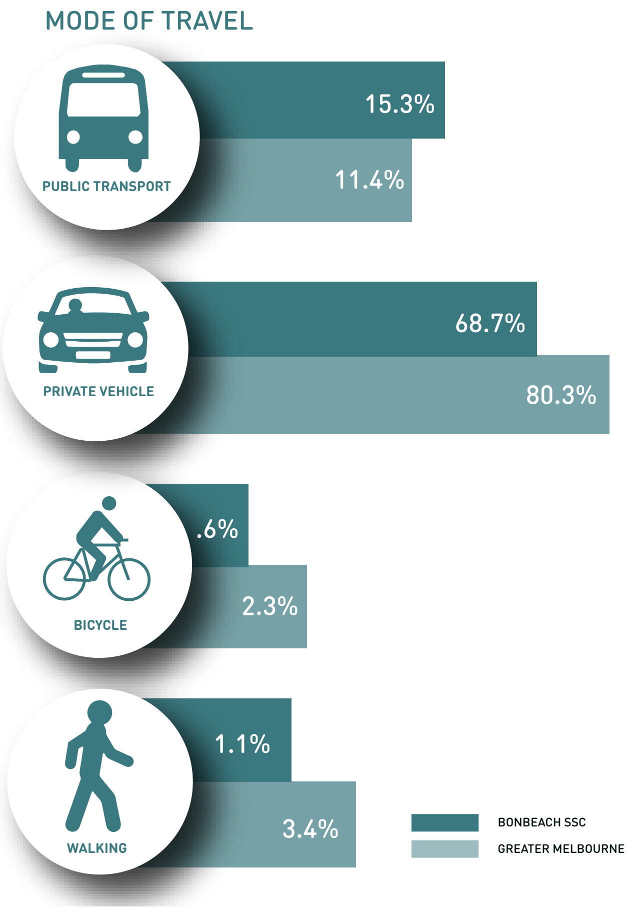


MODE OF TRAVEL

Of the population within Bonbeach, 68.7% of people on an average weekday drive to work. Of these, 3.2% are passengers suggesting that the majority of vehicles are solo-occupied. A further 15.3% travel by public transport, including train, bus, and taxis, while only 0.6% cycled, and 1.1% walked as their only mode of travel.

In comparison to Greater Melbourne, a larger proportion of people catch public transport to work. While slightly smaller proportions drive, it is still significantly the largest mode of transport. Less people use active modes of travel with under 2% cycling and walking in Bonbeach, while percentages are 2 to 3 times higher in Greater Melbourne.

Figure 20 - Modal Share Comparative Analysis



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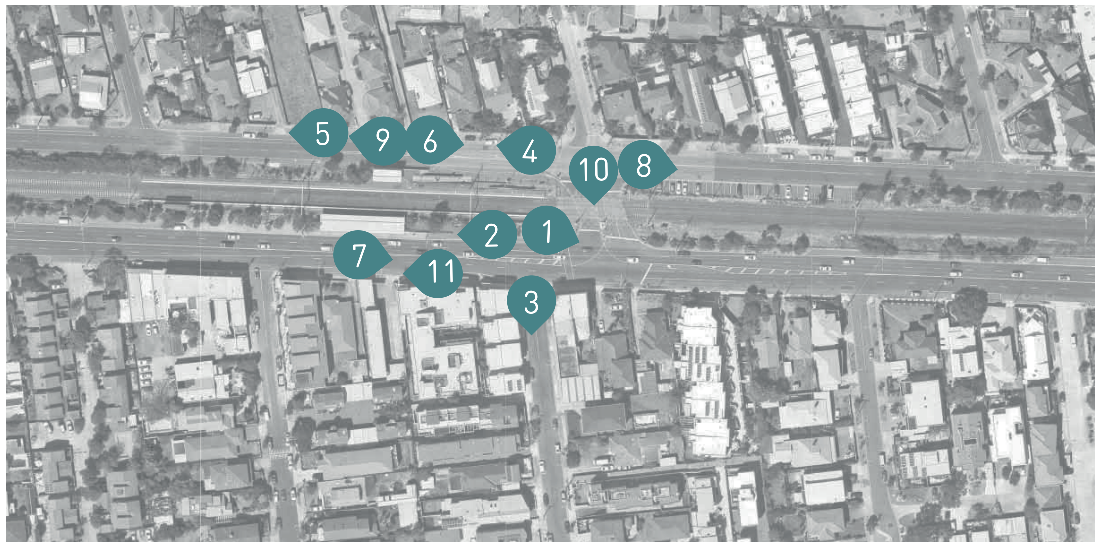
2.5 PHOTOGRAPHIC SURVEY

Figure 21 - Key Map - Bonbeach Photographic Survey



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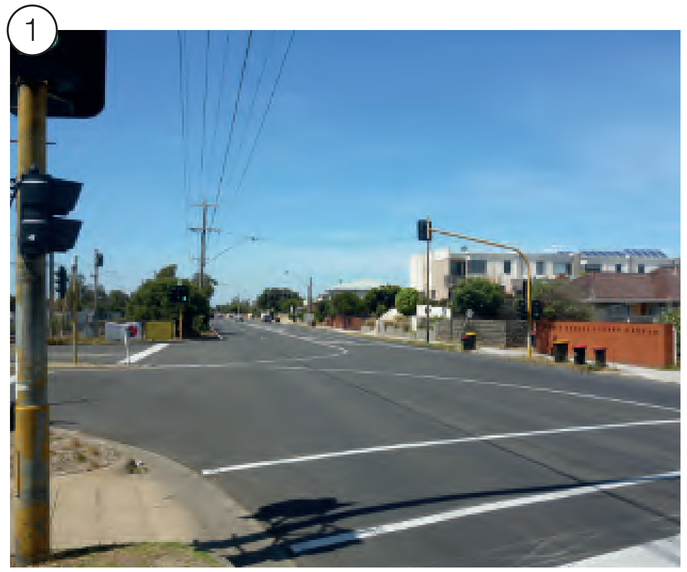

Image 17: Nepean Highway Looking South

②

Image 18: Nepean Highway Looking North

③

Image 19: Harding Avenue towards Port Phillip Bay

④

Image 20: Station Street Looking North

⑤

Image 21: Station Street Looking North

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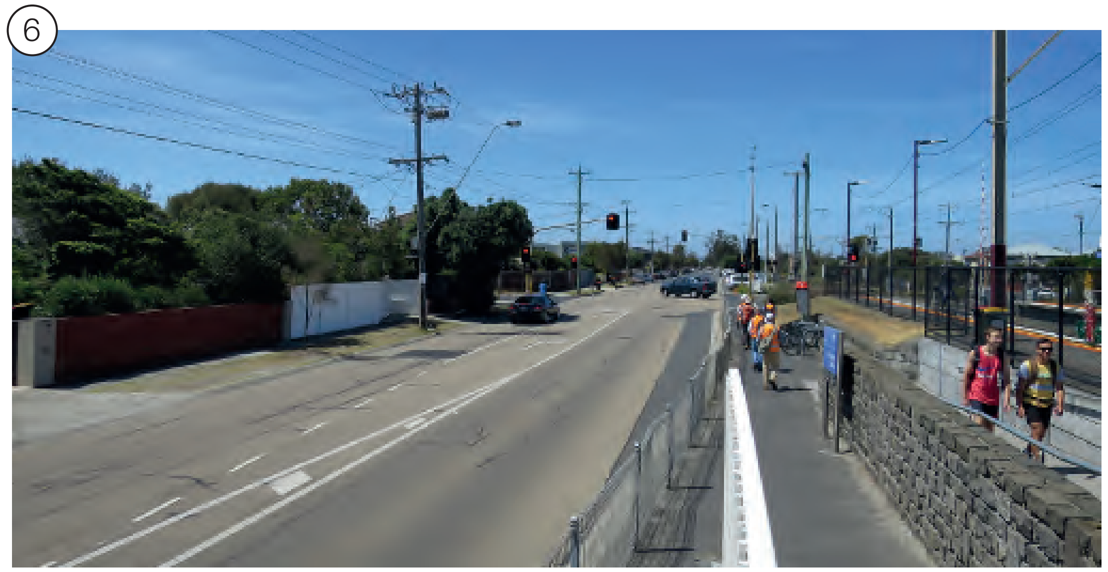

Image 22: Bonbeach Station pedestrian ramp, Station Street looking south

7

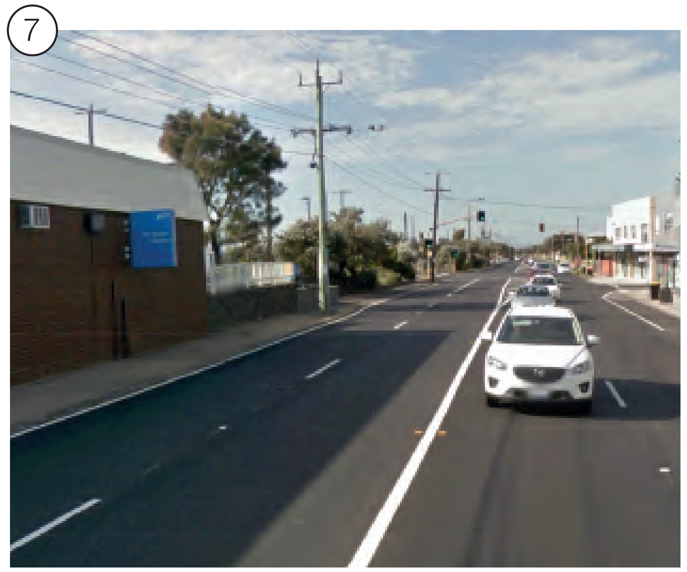

Image 23: Bonbeach Station, Nepean Highway Looking South

8

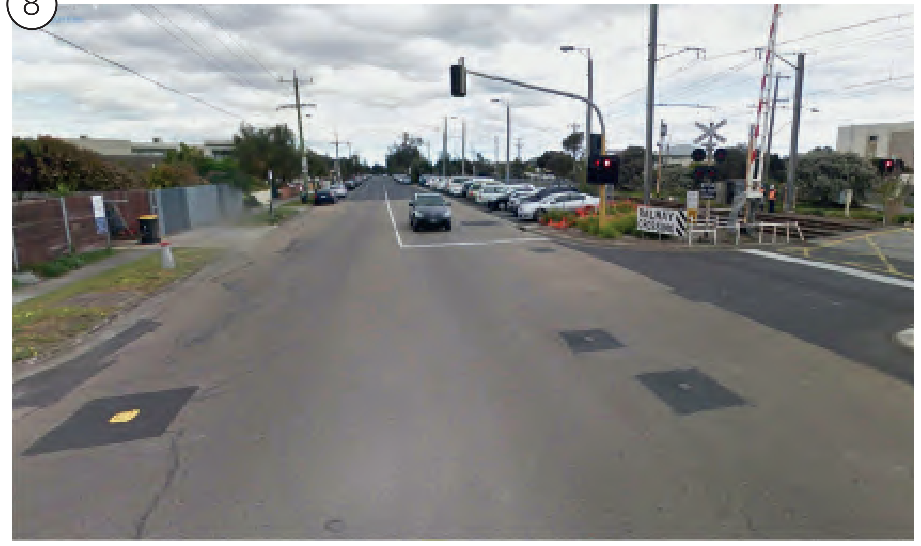

Image 24: Station Street Looking South at Level Crossing

9

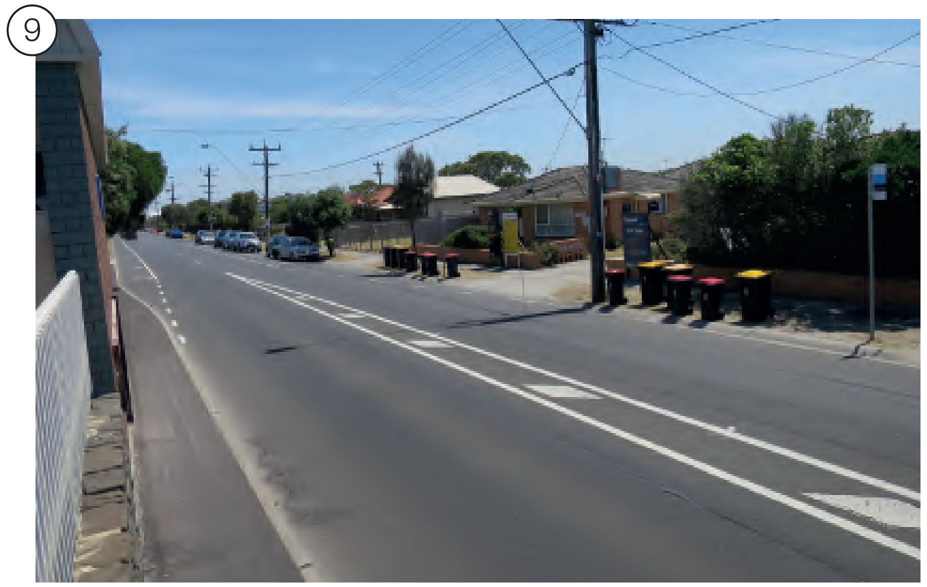

Image 25: Station Street looking north from station

10

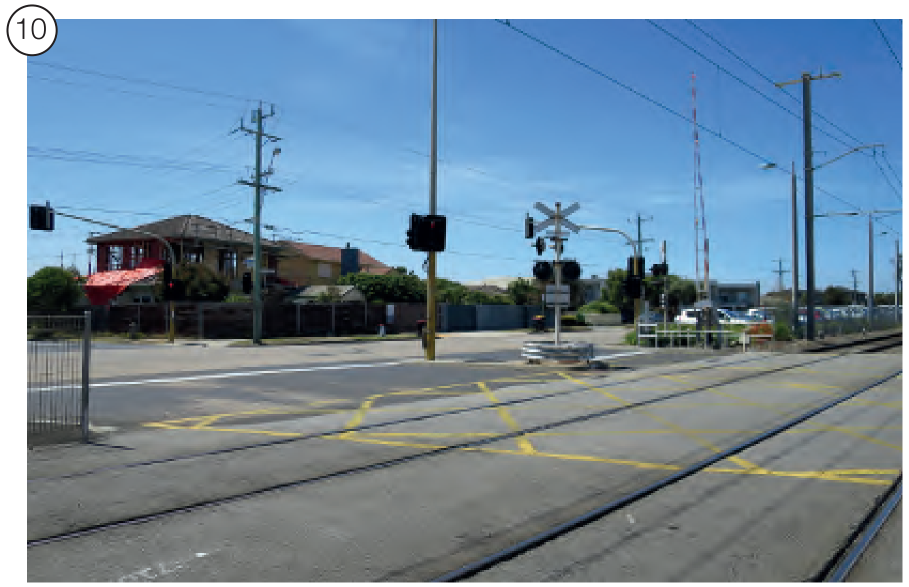

Image 26: Existing Level Crossing, Looking East

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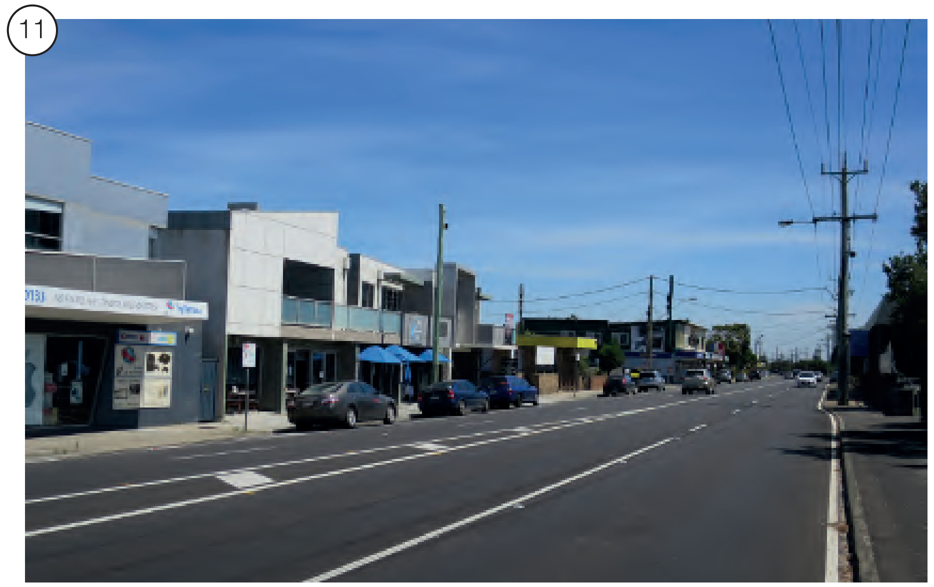

Image 27: Commercial Development along Nepean Highway

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3.0 STRATEGIC PLANNING AND POLICY ANALYSIS

3.1 STATE PLANNING POLICY
3.2 LOCAL PLANNING POLICY
3.3 OTHER STRATEGIES
3.4 RELEVANT PROJECTS

3. STRATEGIC PLANNING AND POLICY ANALYSIS

3.1 STATE PLANNING POLICY

PLAN MELBOURNE

Plan Melbourne 2017-2050 sets out the Victorian Government's strategy to manage the long term growth of metropolitan Melbourne and its population. The strategy identifies the infrastructure, services and major projects that are required to support growth, including the level crossing removal project.

Plan Melbourne recognises that the level crossing removal project will improve the efficiency and safety of the arterial road network across Melbourne and will better connect people to job opportunities in key areas, particularly in Melbourne's west and south-east. It is also identified that the project will create opportunities for urban renewal and development

The Station Street/Bondi Road, Bonbeach level crossing is located within Melbourne's Southern Subregion, as identified in Map 13 of Plan Melbourne. The Southern Subregion contains some of Melbourne's most important activity, economic and employment centres, including the Frankston and Dandenong Metropolitan Activity Centres, the Dandenong National Employment and Innovation Cluster.

The population within the Southern Subregion is expected to increase from 1,140,000 people in 2014 to approximately 1,540,000 in 2031.

SOUTH EAST GROWTH CORRIDOR PLAN

The South East Growth Corridor is identified as a substantial economic region in Melbourne that will eventually accommodate a population of 230,000 or more people and has the capacity to provide for at least 86,000 jobs. The South East Growth Corridor Plan recognises the need to enable improved access to important activity and employment areas within the region and to central Melbourne by improving arterial road and public transport connections.

The level crossing removal at Station Street/Bondi Road, Bonbeach will support the South East Growth Corridor Plan by improving the road, public transport and freight network.

STATE PLANNING POLICY FRAMEWORK

The State Planning Policy Framework (SPPF), contained at Clause 9 to Clause 19 of all Victorian Planning Schemes seek to ensure that land use and development policies in Victoria meet the objectives of planning as set out in the State's Planning and Environment Act 1987. The SPPF provides direction on matters to be considered in all planning decisions and seeks to ensure that the needs of existing and future communities are properly planned having regard to a range of factors

The Clauses which are considered to be relevant to the level crossing removal at Station Street/Bondi Road, Bonbeach include Clause 9 (Plan Melbourne), Clause 11 (Settlement), Clause 11.06 (Metropolitan Melbourne), Clause 15 (Built Environment and Heritage), Clause 17 (Economic Development) and Clause 18 (Transport).

3.2 LOCAL PLANNING POLICY

KINGSTON PLANNING SCHEME

The policies and controls contained in the Kingston Planning Scheme apply to the Station Street/Bondi Road level crossing removal.

Clause 21.02 – Location

Clause 21.02 recognises that Kingston is one of the most diverse municipalities in Melbourne that combines substantial residential areas with activity centres, agricultural and non-urban uses, as well as an industrial sector which forms one of the largest and most concentrated manufacturing regions in Melbourne. Transport corridors in Kingston, including the Frankston railway line and important north-south and east-west arterial routes are recognised as important connections to the regions industrial and commercial areas to local, interstate and international markets.

Clause 21.03 – Land Use Challenges for the New Millennium

Clause 21.03 recognises key land use issues which Council has identified which are likely to challenge the future growth and development within Kingston, including protecting and enhancing ecological values.

Clause 21.04-2 – Key Land Use Themes

Clause 21.04 recognises that Kingston's vision for future land use planning and development is expressed around a number of key land use themes, including retail and commercial land use, environment, wetlands and waterways, transport, movement and access and heritage.

Clause 21.06 – Retail and Commercial Land Use

Clause 21.06 seeks to protect and strengthen the hierarchy of activity centres and their different built form character and function by creating opportunities to strengthen the role of public transport, walking and cycling as a means of accessing centres. Bonbeach is not recognised as a activity centre within the Retail and Commercial Land Use Framework Plan. The closest recognised activity centres are located at Chelsea and Carrum.

Clause 21.08 – Foreshore

Clause 21.08 establishes Council's commitment to the ongoing protection of the social, ecological and environmental values of the Kingston foreshore. A key strategy identified by the policy is to provide fair and equitable access to coastal areas by encouraging a range of transport and access options, such as public transport, cycling and walking. This may be supported by pedestrian and cycling trails along the coast and to inland areas including public transport nodes.

Clause 21.09 Environment Wetlands and Waterways

Clause 21.09 acknowledges that the environmental landscape of the City of Kingston is recognised for its diversity and significance in both a local and regional context. It specifically recognises the role of the Edithvale-Seaford wetlands as an internationally significant wetland area and seeks to protect the physical and habitat diversity of the wetlands and maintain the diversity of flora and fauna habitats within Kingston.

Clause 21.12 – Transport, Movement and Access

Clause 21.12 seeks to create a safe, convenient and efficient road network which meets the transport and freight needs of Kingston's residents, businesses, and through traffic. In addition, it aims to integrate public transport, road, pedestrian and cycle systems with activity centres and social and community infrastructure, as a means of providing equitable and safe vehicular, pedestrian and cyclist movement and access for the community.

It recognises the existing road capacity issues causing conflicts between high traffic volumes, activity centres and residential areas in the City of Kingston. Strategies to address this include the establishment of a functional hierarchy of local and regional road networks to improve efficiency and safety; the integration of public transport, road, pedestrian and cycle networks with activity centres, schools, and community facilities to provide equitable access for the community; and the protection and enhancement of amenity of sensitive areas through the appropriate management of transport networks.

Clause 21.13 – Heritage Policy

Clause 21.16 seeks to identify, protect, conserve and manage places or elements of cultural heritage significance within Kingston.

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ZONING AND OVERLAYS

Planning Zones

A number of zones affect the area surrounding the project. These are identified below and the relevant zoning map is shown in Appendix C.

The Bonbeach Railway Station and the rail corridor are affected by the Public Use Zone 4 –Transport (PUZ4). The application of this zone recognises the use of this land for transport purposes.

Nepean Highway is affected by the Road Zone Category 1 (RDZ1). The zone identifies significant existing roads or land that has been acquired for a significant proposed road. Road reservation affected by this zone is managed by VicRoads, who are also the referral authority under the zone.

The land to the north-east, south-east and south-west of the level crossing removal site is located within the General Residential Zone – Schedule 2 (GRZ2). The GRZ2 provides for moderate housing growth up to a maximum of 11 metres, as well as educational, recreational, religious, community and a limited range of other non-residential uses to serve local community needs in appropriate locations.

The land to the immediate north-west of the level crossing removal site is located within the Commercial 1 Zone (C1Z). The C1Z seeks to create vibrant mixed use commercial centres for retail, office, business, entertainment and community uses by providing for a variety of retail, office, business, entertainment, education and community uses. Residential uses at densities complementary to the role and scale of the commercial centre are also encouraged.

A number of zones affect the land beyond the immediate surrounds of the level crossing removal site, including: General Residential Zone – Schedule 3 (GRZ3), Mixed Use Zone (MUZ), Neighbourhood Residential Zone (NRZ), Public Park and Recreation Zone (PPRZ), Public Use Zone – Service & Utility (PUZ1), Public Use Zone – Education (PUZ2), Road Zone Category 2 (RDZ2) and Special Use Zone (SUZ1).

A detailed analysis of the land use zones can be found in the Land Use report prepared as part of the EES.

Planning Overlays

A number of overlays affect the area surrounding the project. These are identified below.

Design and Development Overlay - Schedule 1 (DDO1) and Design and Development Overlay – Schedule 7 (DDO7) applies to land immediately north-west and south-west of the level crossing removal site, between Port Phillip and the Frankston rail corridor. DDO1 seeks to protect and enhance the visual and aesthetic appearance of the Port Phillip foreshore area by ensuring that building heights, bulk and setbacks are compatible with surrounding buildings and natural features, and are sympathetic to the surrounding natural landscape and environment. In addition to these objectives, DDO7 seeks to ensure that new buildings and works are appropriately setback from the Port Phillip foreshore reserve boundary.

A number of overlays affect the land beyond the land in the immediate surrounds of the level crossing removal site, including: Environmental Audit Overlay (EAO), Environmental Significance Overlay (ESO), Development Plan Overlay – Schedule 6 (DPO6), Heritage Overlay (HO), Land Subject to Inundation Overlay (LSIO) and Special Building Overlay (SBO).

3.3 OTHER STRATEGIES

SMARTROADS (VICROADS)

SmartRoads is a policy designed to manage the increasing number of trips taken on roads in Victoria. It aims to address the competing interests for limited road space by giving priority to certain transport modes at particular times of the day. SmartRoads recognises the increasing importance of public transport, walking and cycling as transport modes, and has therefore established a set of guiding principles for the priority use of roads by transport mode, time of day, and place of activity. This ensures that decisions about the operation of the road network support integrated land use and transport planning. Nepean Highway is identified within the policy as an existing arterial traffic route.

PRINCIPAL BICYCLE NETWORK (VICROADS)

The Principal Bicycle Network (PBN) is a network of existing and proposed bicycle routes identified to help people ride to major destinations around metropolitan Melbourne. First developed in 1994, it was recently reviewed to focus more on getting people into activity centres and to make more use of local roads and off-road paths. The current plan was released in 2012. Nepean Highway, the Patterson River shared use trail and the Edithvale-Seaford Wetlands shared use trail is identified within the policy as part of the PBN.

NETWORK DEVELOPMENT PLAN (PTV)

The Network Development Plan is a strategy to address the rapid growth in train patronage across Melbourne's metropolitan network forecast for the next 20 years and beyond. Key strategies of the plan include expanding the capacity of the existing network; the redesign of train services to maximise opportunities for the seamless coordination with buses and trains; and to extend the network into new growth areas. The strategy includes the introduction of a metro-style train system for Melbourne to provide more high capacity and high frequency services.

FRANKSTON CORRIDOR URBAN DESIGN STRATEGY

An Urban Design Strategy for the Frankston Railway Line corridor is currently being prepared by the LXRA. The purpose of the strategy is to identify the urban design opportunities for all level crossing projects undertaken along the Frankston Railway Line by the LXRA and ensure a coordinated approach to the design of the level crossing removal projects.

The Strategy identifies potential actions across State government departments, authorities, agencies, and local government that impact upon or should be considered in the planning and implementation of level crossing removals.

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4.0

COMMUNITY AND STAKEHOLDER ENGAGEMENT

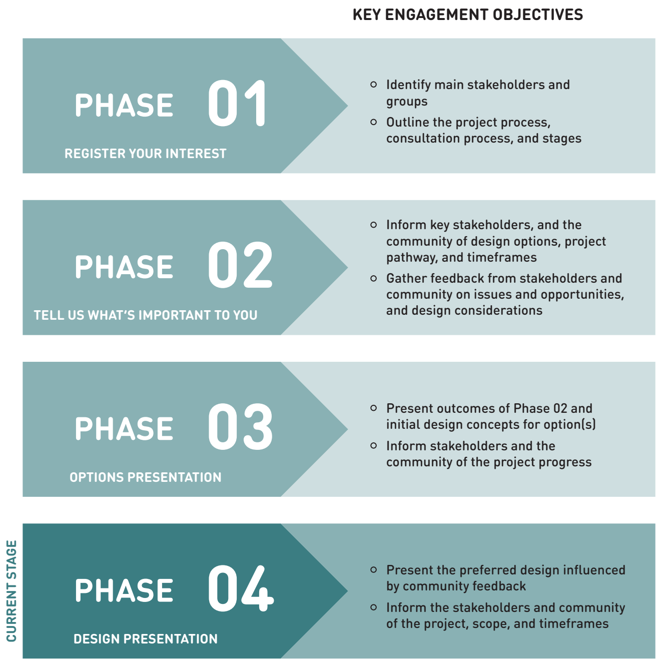
4.1 OVERVIEW
4.2 STAKEHOLDER ENGAGEMENT
4.3 COMMUNITY CONSULTATION

4. COMMUNITY AND STAKEHOLDER ENGAGEMENT

4.1 OVERVIEW

Community and stakeholder engagement plays an important role in developing and shaping the Station Street/Bondi Road, Bonbeach level crossing removal project. The LXRA has undertaken an extensive engagement program to ensure the Bonbeach community and stakeholders are informed, involved and are able to actively contribute to the development of the level crossing removal project.

Figure 22 - Engagement Phases



PHASE 01 – REGISTER YOUR INTEREST
- Identify main stakeholders and groups
- Outline the project process, consultation process, and stages

PHASE 02 – TELL US WHAT'S IMPORTANT TO YOU
- Inform key stakeholders, and the community of design options, project pathway, and timeframes
- Gather feedback from stakeholders and community on issues and opportunities, and design considerations

PHASE 03 – OPTIONS PRESENTATION
- Present outcomes of Phase 02 and initial design concepts for option(s)
- Inform stakeholders and the community of the project progress

PHASE 04 – DESIGN PRESENTATION
- Present the preferred design influenced by community feedback
- Inform the stakeholders and community of the project, scope, and timeframes

4.2 STAKEHOLDER ENGAGEMENT

KINGSTON CITY COUNCIL

Kingston City Council was directly engaged by the LXRA consultation program in meetings, briefings, attendance at information sessions and representation on the Technical Reference Group (TRG). The TRG was formed for the purposes of the EES

Kingston City Council maintains an interest in supporting and promoting a wider mix of commercial, residential and retail uses in Bonbeach Neighbourhood Centre and encourages a consistent built form as the centre develops.

Council have been engaged throughout the development of the station and have been a strong advocate for prioritising and promoting walking and cycling through the provision of safe, attractive and functional infrastructure for active transport users.

METRO TRAINS MELBOURNE AND PUBLIC TRANSPORT VICTORIA

MTM and PTV are responsible for rail infrastructure in metropolitan Melbourne and have developed preliminary patronage forecasts and a range of policies that influence design of the station and the wider station precinct. These include vertical transportation, station layout, car parking provision and service vehicle standards.

Other elements that affect the urban design quality of the project include landscape guidelines, fence and barrier and other safety requirements along the rail corridor developed by MTM. Both MTM and PTV have been actively involved in the development of Bonbeach Station and have provided advice throughout its development.

VICROADS

VicRoads is responsible for the management of the metropolitan road network, with specific responsibility for Nepean Highway as an arterial road and any associated road signals. Strict standards exist for road alignment design, maximum gradients, traffic visibility and height clearances.

Standards that strongly influence the urban design opportunities include minimum clearances between the traffic lanes and roadside hazards, traffic barrier requirements, and the separation of intersections and signals along arterial routes. VicRoads has been actively engaged throughout the design process.

OTHER STAKEHOLDERS

Other key stakeholder groups, whose particular interests and needs have been considered in the development of options, include:

- Chelsea and Bonbeach Station Group;
- Local residents;
- Local traders;
- Local schools;
- Service Authorities;
- Pacific National (freight rail operator),
- Department of Environment, Land, Water, and Planning (DELWP);
- Victorian Planning Authority (VPA); and
- Office of the Victorian Government Architect (OVGA).

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4.3 COMMUNITY CONSULTATION

CONSULTATION PROCESS

Community members have been invited throughout the project to review, discuss and share their feedback in relation to the level crossing removal project. Four phases of engagement have been undertaken to date.

From February 2016 to June 2016, awareness-raising and feedback gathering activities created opportunities for local communities to learn about the level crossing removal project and to share what is important to them in their local area.

During this period, nine community information sessions were held with 500 community feedback forms, 4,500 pieces of online feedback and over 200 phone/email enquiries received from local residents, community groups and traders.

The initial feedback, alongside the technical investigations, helped to identify two viable options for the level crossing removals – a rail bridge under Station Street/Bondi Road and a rail bridge over Station Street/Bondi Road. Community feedback on the two options was sought through the next phase of consultation, which was carried out in September/October 2016.

In November 2016, the recommended rail under road option was presented to the community. Further feedback and local knowledge was also sought to shape the details of the option ahead of the tender process. This included a community workshop to capture local ideas and views about the project, undertaken in September 2017.

In addition to the formal engagement activity, LXRA staff spoke with concerned residents to discuss the project design solution, answer questions, hear concerns and capture views on the detailed aspects of the projects at Bonbeach.

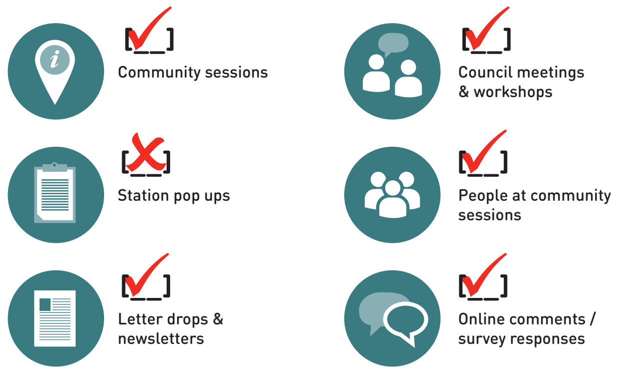
EMERGING THEMES

A number of themes have emerged from the community consultation exercises undertaken to date. These include:

- Importance and value of the landscape character and further enhancement along the whole of the rail corridor;
- Desire to balance user needs so that all users and all transport modes are catered for equitably to ensure that the solution benefits a broad cross section of the community; and
- The need for the design and materials to respond to and reflect the valued natural coastal setting and emerging architecture.

Community and stakeholder feedback will be used as part of the EES process. It will also be used during the project's tender and detailed design phase to further shape the project and deliver positive outcomes for the Bonbeach community.

Figure 23 - Community Consultation Snapshot


☑ Community sessions
☑ Council meetings & workshops
☒ Station pop ups
☑ People at community sessions
☑ Letter drops & newsletters
☑ Online comments / survey responses

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5.0

ISSUES AND OPPORTUNITIES

5. ISSUES AND OPPORTUNITIES

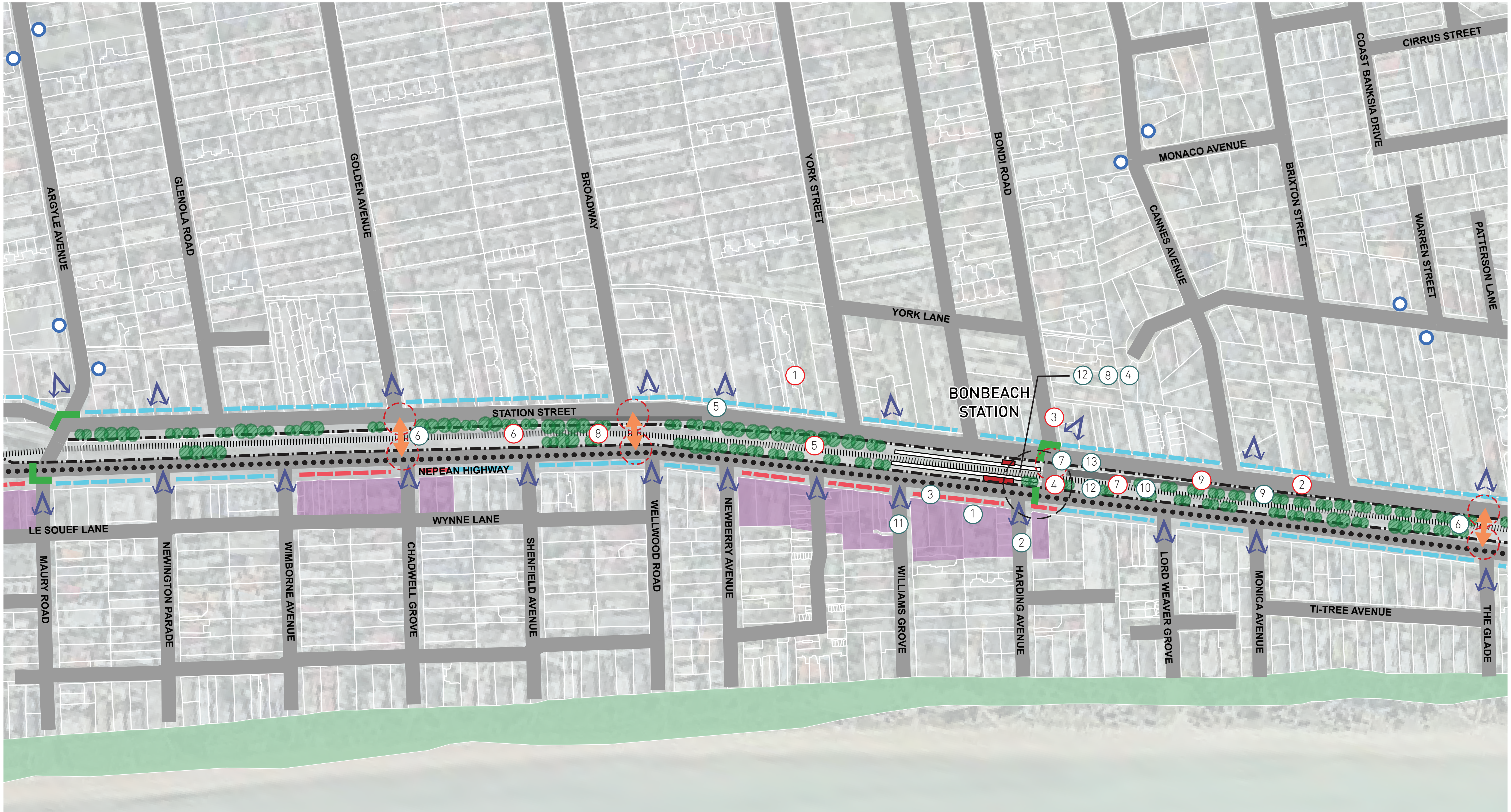

Figure 24 - Issues and Opportunities Analysis

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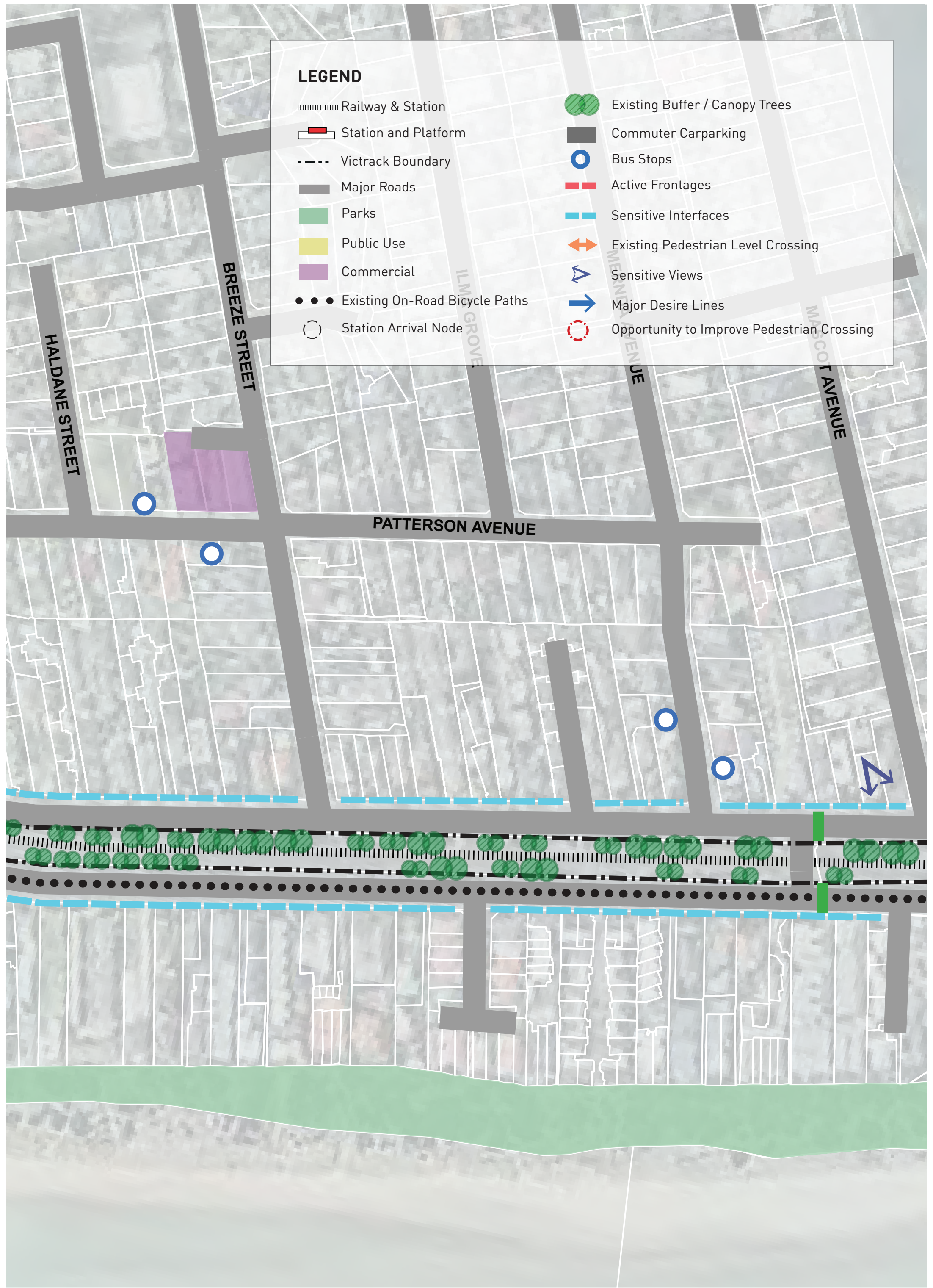

Based on the preceding analysis presented in this document, a number of issues and opportunities for the project site have been identified that the guidelines address. It is expected that design teams may identify further issues and opportunities through their analysis. These are summarised below:

ISSUES

① Proximity of residential uses along the length of the rail corridor, which may be sensitive to visual and noise impacts.

② The narrow configuration of Station Street and Nepean Highway either side of the rail line which restrict the amount of space available for all modes of transport, particularly pedestrians.

③ Limited pedestrian access between residential housing tothe east of the rail corridor and local destinations to the west.

④ Poor pedestrian crossing amenity and safety at existing road intersections.

⑤ Limited space available within the rail corridor to accommodate significant planting.

⑥ Discontinuous and low grade planting along the rail corridor.

⑦ Operational and design standards of road and rail infrastructure that may limit additional planting opportunities.

⑧ Protection of landscape values related to the Edithvale-Seaford Wetlands.

⑨ Unsafe car parking along Nepean Highway which encourages pedestrians to informally cross the road.

OPPORTUNITIES

① Provision of better local access to the Neighbourhood Centre along Nepean Highway and recreational and foreshore spaces opposite the station.

② Better visual and physical integration of the station precinct with the foreshore.

③ Enhancement of the existing streetscape and public realm character of the area that is considerate of the existing built form and streetscape of the Neighbourhood Centre.

④ Opportunity to provide a built form outcome that responds to heritage and civic elements in the area and strengthens the quality of the local built form character.

⑤ Improved views towards the rail corridor from surrounding uses on parallel streets.

⑥ Provision of additional pedestrian crossing opportunities over the rail corridor.

⑦ Improvements to the Station Street/Bondi Road and Nepean Highway intersection to provide additional crossing opportunities.

⑧ Improvements to the customer and public transport facilities at Bonbeach Station.

⑨ Provision of safe and improved walking and cycling infrastructure along the length of the rail corridor.

⑩ Improvements to the safety, location, access and number of car parking spaces.

⑪ Enhance visual and physical links to open space and recreational amenities.

⑫ Provision of planting to support the landscape and character of the local area.

⑬ Provision of a localised bus route and services connecting at the station precinct.

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6.0

DESIGN GUIDELINES

6.1 GUIDELINES STRUCTURE

6.2 VISION

6.3 DESIGN GUIDELINES

6.4 DESIGN GUIDELINE PROJECT SECTIONS

6. DESIGN GUIDELINES

6.1 GUIDELINES STRUCTURE

There are three parts to the design guidance:

(1) VISION

The vision statement (set out in Section 6.2) puts forth the ambition of the level crossing removal for the Station Street/Bondi Road level crossing site. It is site specific and has been developed based on advice and input from the Urban Design Advisory Panel (UDAP).

(2) STRATEGIC OBJECTIVES

The strategic objectives are high level performance outcomes underpinning the vision and drafted for each principle, which must be achieved through the design response.

(3) DESIGN GUIDELINES

The design guidelines are more targeted and outline how the design response should achieve the principles within the Urban Design Framework. The guidelines are not based on a reference design for a single preferred option, but rather are intended to apply to all options. Further design innovation is encouraged, to better achieve the project objectives and vision.

The design guidelines set out in this section, are structured in 3 main parts, as illustrated in Figure 25. The guidelines set out site specific performance outcomes and design requirements, that must be achieved for the Station Street/Bondi Road, Bonbeach site.

ROLE OF GUIDELINES

While the guidelines have been prepared as a requirements document to direct the Alliance's design response, it is not intended to preclude further design innovation.

The guideline provisions address urban design matters, primarily built form, movement and landscaping elements. It covers requirements for three urban contexts, including the station precinct, the transition zone between the station and the wider precinct, and the corridor and wider precinct area (Refer to Figure 26). This concept has been adapted from the model established by VicRoads for some of the early level crossing removal projects.

The design guidelines have been shaped by the preceding analysis, community and stakeholder engagement, and broader urban design principles, objectives and standards set out in the Urban Design Framework.

The guideline provisions have been developed according to the overarching UDF principles, and design considerations noted in Table 1, for the different contexts.

Figure 25 - Urban Design Guidelines Structure

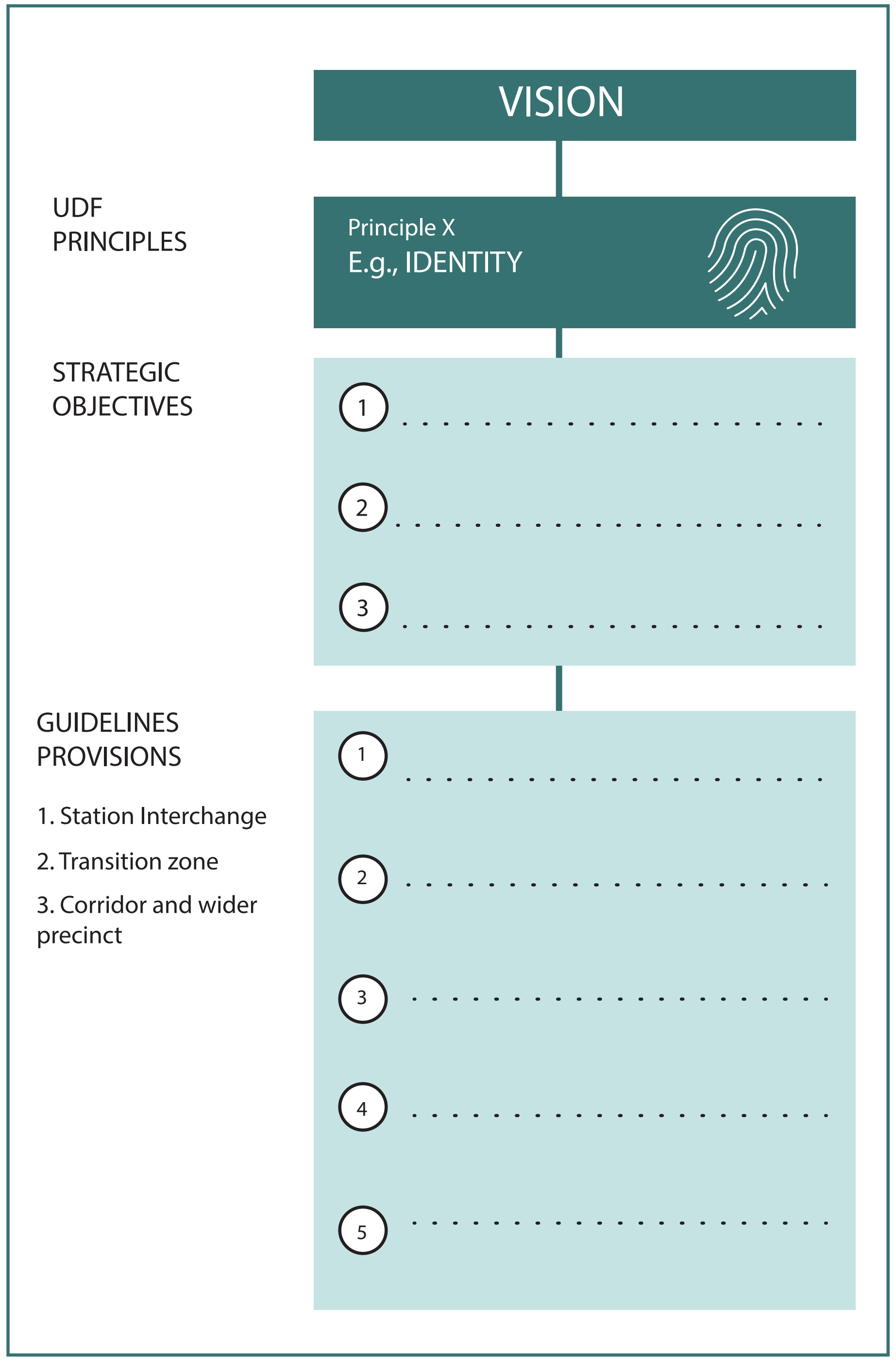
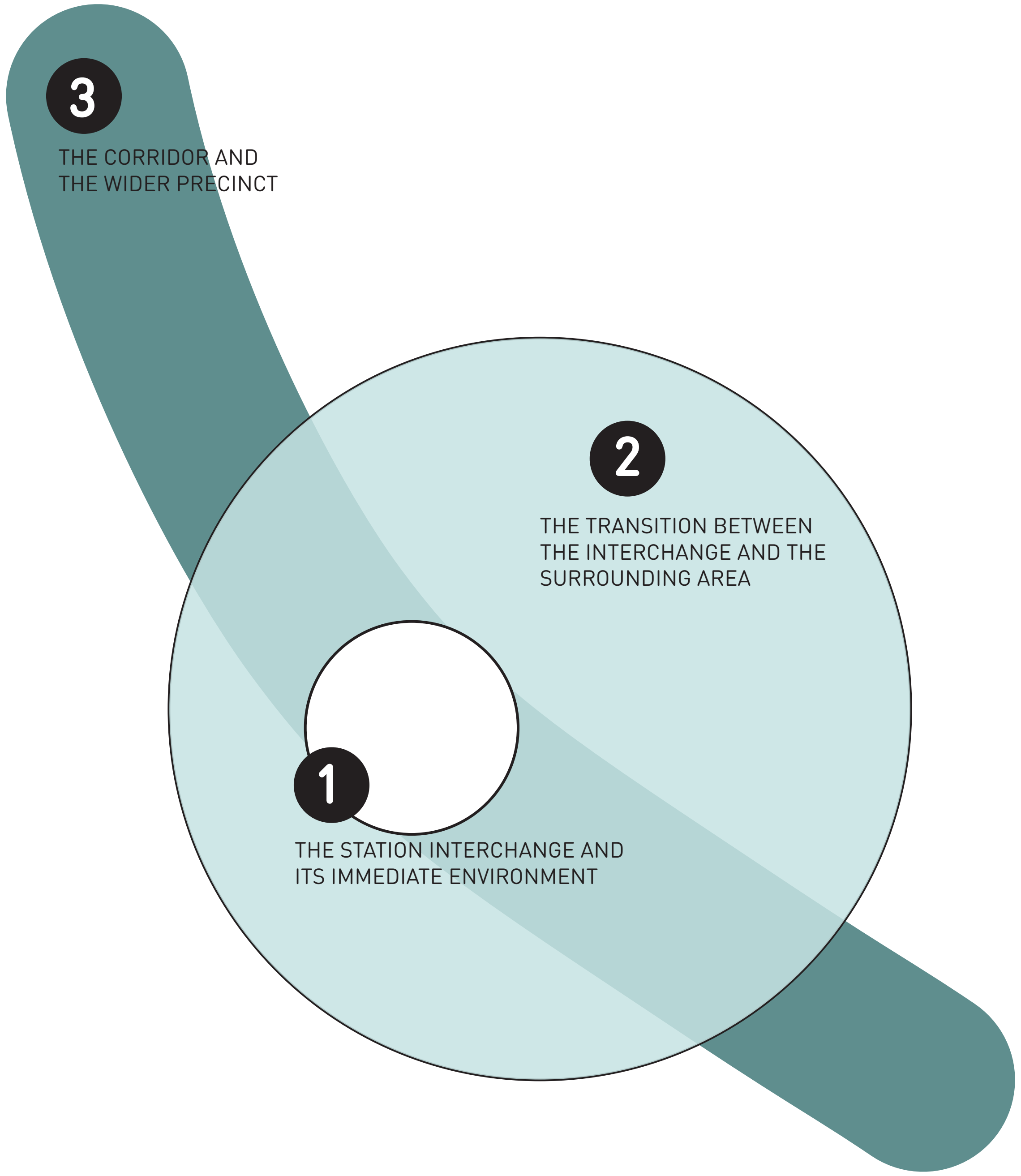


Figure 26 - Urban Contexts


3
THE CORRIDOR AND THE WIDER PRECINCT
2
THE TRANSITION BETWEEN THE INTERCHANGE AND THE SURROUNDING AREA
1
THE STATION INTERCHANGE AND ITS IMMEDIATE ENVIRONMENT

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6.2 VISION

The Station Street/Bondi Road, Bonbeach Level Crossing Removal Project will create a high quality and lasting local landmark that will strengthens the landscape character of the rail corridor. Upon completion, the project will connect the surrounding public spaces, enhance the attractiveness of the Bonbeach Neighbourhood Centre, and improve transport access and amenity across Bonbeach.

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6.4 DESIGN GUIDELINES

PRINCIPLES 1 AND 3: IDENTITY + URBAN INTEGRATION

STRATEGIC OBJECTIVES

1. STRENGTHEN THE LOCAL NEIGHBOURHOOD CHARACTER

   The design response should respond to and complement the existing built form and public realm character of Bonbeach to create a cohesive neighbourhood centre.

2. PROTECT AND STRENGTHEN COASTAL LANDSCAPE

   The local landscape character should establish a sense of place that is specific to Bonbeach by referencing and integrating existing species found along the rail corridor and on the foreshore.

3. INTEGRATE THE STATION WITH THE NEIGHBOURHOOD CENTRE

   Create a cohesive station precinct and neighbourhood activity centre through design detail and visual cues.

4. MINIMISE POTENTIAL VISUAL IMPACTS

   The design should minimise or address visual amenity impacts to sensitive interfaces along the rail corridor and ensure that the station design and landscaping maintain and enhance key viewlines from adjacent public places and from key streets.

GUIDELINES

① The scale, materials, textures and colours of the station building must respond to and complement the prevailing low scale, modest, coastal character of the surrounding area. The use of natural materials, colours, and textures should be used prominently as appropriate.

② Explore opportunities to extend elements of the project's public realm design into Williams Grove, Harding Avenue and/or Lord Weaver Grove that further integrates with the key elements of the coastal identity of Bonbeach (including the beach boxes and the Surf Life Saving Club).

③ Maintain some continuity of design detail, materials and forms used in other Frankston Railway Line projects, especially the Edithvale, Carrum and Seaford Level Crossing Removal projects.

④ Provide an integrated design response to fencing, barriers and pedestrian overpasses along the rail corridor that are consistent with the character and quality of the station building, and provides visual interest at both pedestrian and passing vehicle scales.

⑤ High quality public realm materials, details and landscaping should be incorporated into the design of the station plaza.

⑥ Provide a high quality terminus view of the rail corridor from local streets that intersect with Station Street and Nepean Highway through landscaping or public realm/built form detailing, particularly Broadway, Williams Grove, Harding Avenue, Bondi Road, Lord Weaver Grove, and Cannes Avenue.

⑦ Avoid additional road barriers through the considered location and specification of any built form and significant canopy trees outside of VicRoads prescribed clear zones along Nepean Highway and Station Street, or securing any possible waivers and exemptions.

⑧ Ensure any advertising signage within the rail corridor does not dominate the public realm or detract from the architectural design intent and landscaping of the station precincts and rail corridor, particularly at the terminus of views from local streets.

⑨ Minimise or manage light spill from station buildings and car parking to sensitive land uses adjacent to the rail corridor such as housing and retail within the Bonbeach neighbourhood centre.

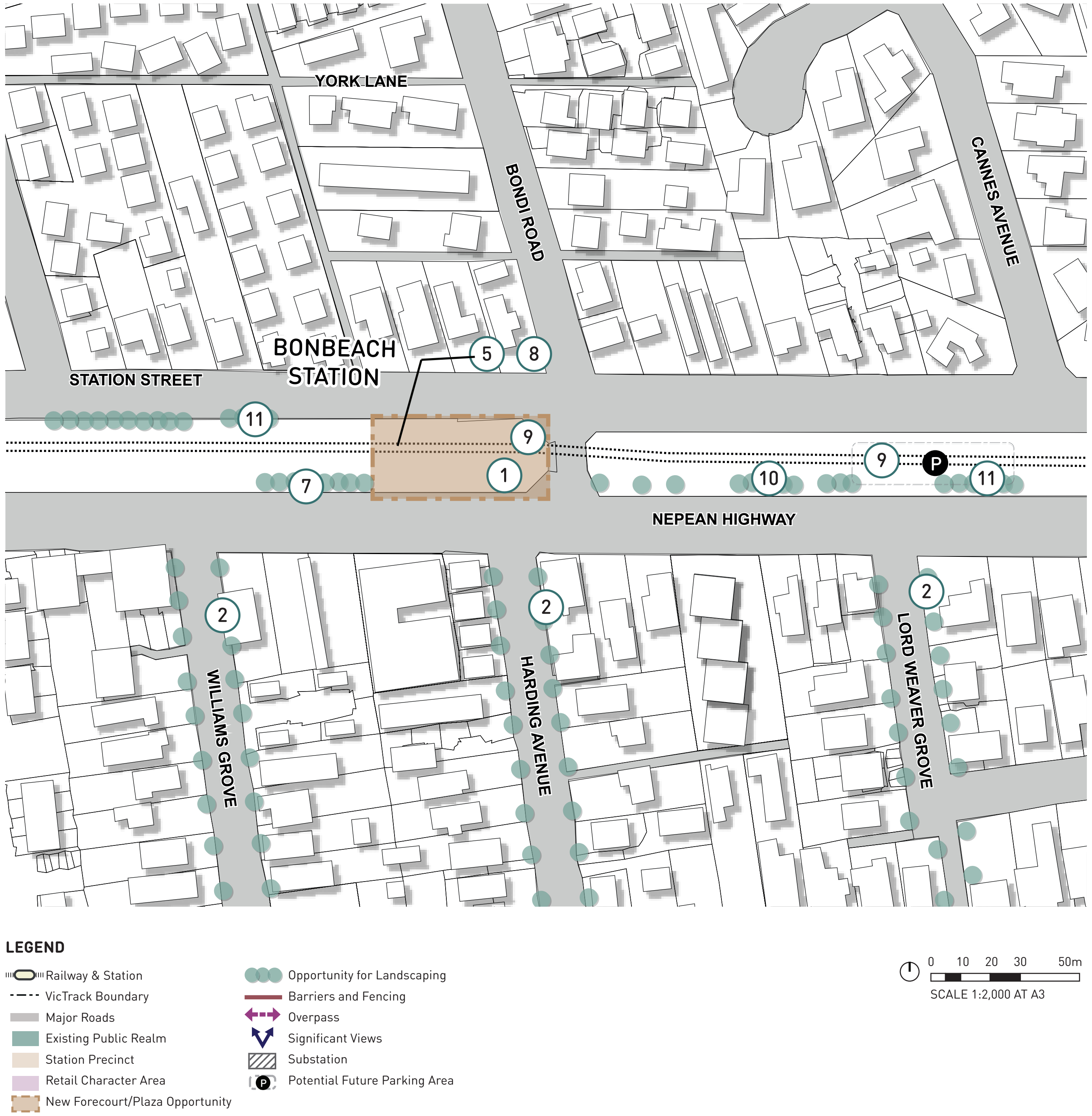
⑩ Maximise opportunities to reinstate or establish coastal tree species, shrubs and other landscaping along Nepean Highway and Station Street to provide a visual buffer to the built form elements.

⑪ Provide an integrated landscape strategy that uses planting opportunities along both sides of Station Street and Nepean Highway as a way of strengthening the landscape character of the corridor and provide high quality and positive visual outcomes.

⑫ Minimise pavements along the Nepean Highway interface where continuous cycling and pedestrian movement is not required in order to maximise the landscape potential of this part of the corridor.

⑬ Provide indented roadside car parking arrangements along both Station Street and Nepean Highway kerbs where car parking is provided in order to accommodate street tree planting.

Figure 28 - Identity and Urban Integration Guidelines Enlargement



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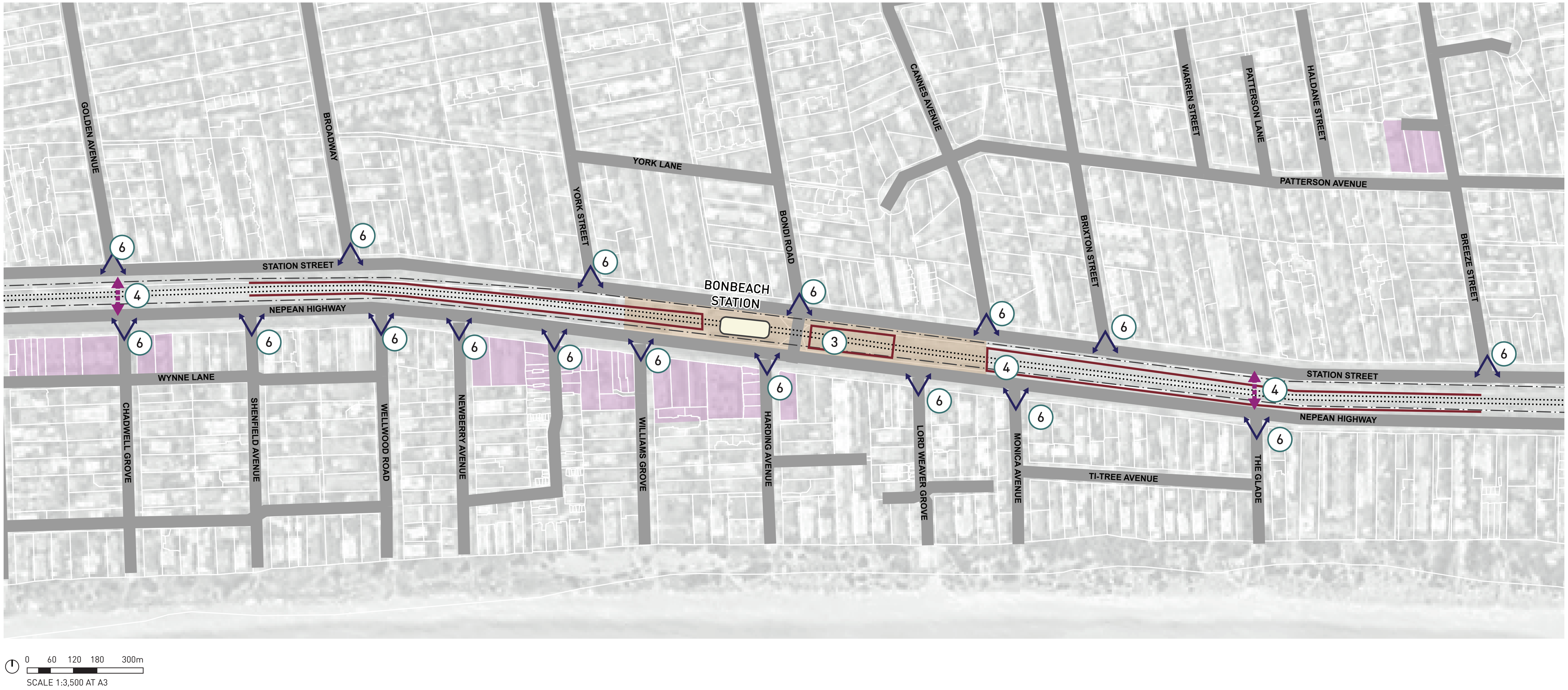
PRINCIPLES

IDENTITY	A well defined identity and sense of place are key to creating strong and vibrant communities.
URBAN INTEGRATION	Well-integrated environments provide a sound framework for the successful development of great places.

Figure 29 - Identity and Urban Integration Guidelines Plan



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6.4 DESIGN GUIDELINES

PRINCIPLES 2 AND 8: CONNECTIVITY AND WAYFINDING + ACCESSIBILITY

STRATEGIC OBJECTIVES

1. IMPROVE CONNECTIVITY TO THE STATION

   The design response should improve and establish connections that provide safe, direct movements to and from the station with the broader area from existing networks for all modes of transport establish safe and direct inter-modal connections.

2. PRIORITISE ACTIVE TRANSPORT MODES

   The design and arrangement of the precinct shall prioritise the safety and amenity of pedestrians and cyclists over private vehicles to encourage use of active transport modes to access the station.

3. PROVIDE A UNIVERSALLY INCLUSIVE DESIGN

   Ensure the design provides universal access within the station and wider corridor and the station and promotes equity for all users.

GUIDELINES

① Integrate the network plans for all modes of transport in the station precinct, with a priority for pedestrian movement in proximity to the station and the neighbourhood centre.

② Provide dedicated walking and cycling infrastructure along the Station Street side of the rail corridor that provides for safe management of pedestrian and cycling movements along this corridor as well as to the station and the neighbourhood centre from the broader precinct.

③ Establish clear and direct pedestrian linkages between the station entrances to bus bays, commuter carparking, and bicycle storage locations.

④ Reinstate pedestrian crossings over the rail corridor with DDA compliant overpasses at Golden Avenue and The Glade and incorporate stair access where in order to maximise their accessibility from all directions.

⑤ Provide clear, intuitive and suitably wide paths at accessible slopes that allow for ease of movement for pedestrians around the station to car parking and pedestrian crossing/ overpass locations and provide an adequate clearance from traffic lanes.

⑥ Maintain and enhance sightlines to the foreshore from the station precinct to assist the orientation of users, particularly via Williams Grove, Harding Avenue and Lord Weaver Grove.

⑦ Allow for the future provision of bus bays on Station Street and locate these to be clearly visible and identifiable from both station entrances and the Bonbeach neighbourhood centre.

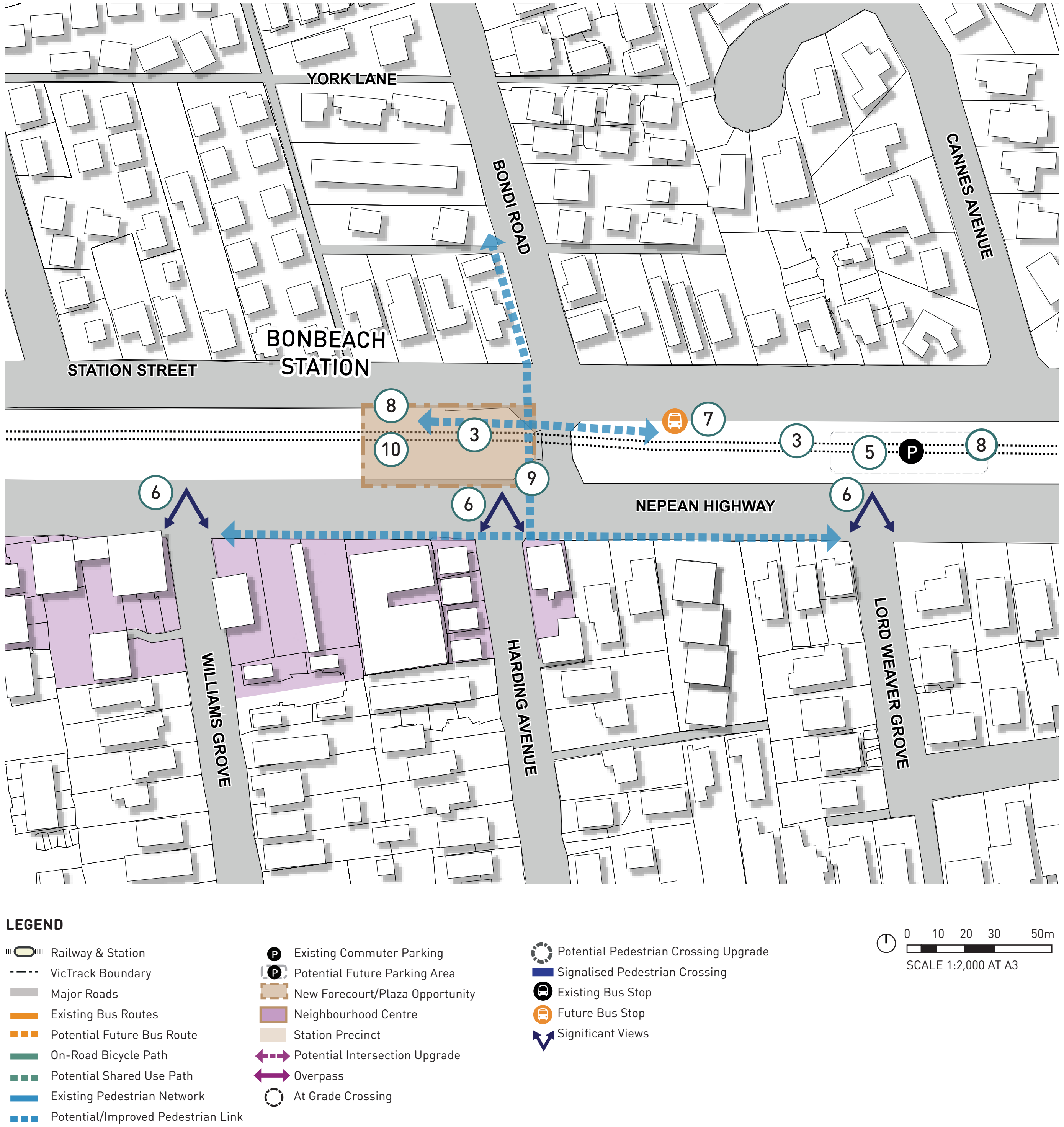
⑧ Locate commuter car parking and bus bays in close proximity to a station entrance.

⑨ Provide suitable wide and functional pedestrian and cycle pathways around the station precinct that address key desire lines to station amenities, local streets, and adjacent destinations.

⑩ Locate all bicycle parking to be visible and have direct access from the station entrance and cycling infrastructure along Station Street.

⑪ Orient and locate pedestrian overpasses to minimise impacts on existing pedestrian journey times to key local features.

Figure 30 - Accessibility, Connectivity and Wayfinding Guidelines Enlargement



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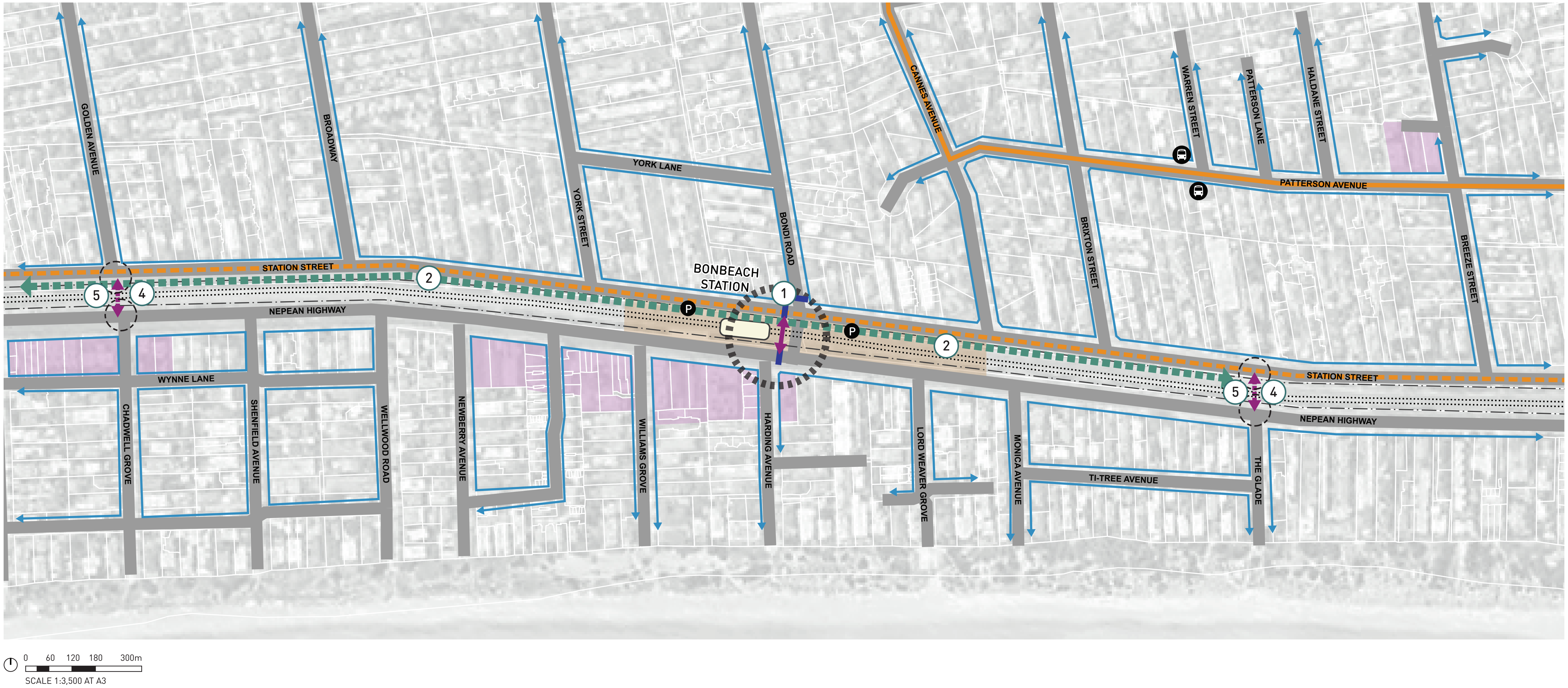
PRINCIPLES

CONNECTIVITY AND WAYFINDING	Well connected and legible places contribute significantly to strong economies and healthy, inclusive communities.
ACCESSIBILITY	Highly accessible and inclusive environments encourage positive activation and contribute to prosperity, well being and the perception of care within communities.

Figure 31 - Accessibility, Connectivity and Wayfinding Guidelines Plan



WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

6.4 DESIGN GUIDELINES

PRINCIPLES 5 AND 7: AMENITY + SAFETY

STRATEGIC OBJECTIVES

1. ESTABLISH A SENSE OF SAFETY

   Design the station precinct to feel safe through passive surveillance opportunities and eliminate of conflicts between modes and users.

2. IMPROVE USER COMFORT

   Incorporate measures across the station precinct to enhance user enjoyment such as shade, wind protection, and public amenities in appropriate locations.

GUIDELINES

① Maximise visual connections and transparency between the station platform to the station concourse and to pedestrian activity along Station Street and Nepean Highway.

② Ensure a large proportion of the platform is open to the sky to provide natural sunlight and passive surveillance opportunities over the station platform from Station Street and Nepean Highway

③ Ensure well-lit platforms that provide high-levels of illumination and reduce the contrast between day-lit and artificially lit areas of the platform to assist visibility of users and improve the sense of safety.

④ Ensure walking and cycling infrastructure and any highly pedestrianised areas are designed to minimise conflicts issues between users through clear delineation of spaces and traffic management measures, particularly at the station entrance.

⑤ Ensure the platform environment is a comfortable, well-lit, and inviting space for users by eliminating concealed spaces and providing lighting, clear views and adequate shelter from weather conditions.

⑥ Provide light-reflective, high-quality materials on floor, wall and ceiling surfaces at the platform level that are commensurate with the quality of an internalised space.

⑦ Provide weather protection, lighting, comfortable seating and public amenities, such as waste bins and drinking fountains in appropriate locations in the station precinct.

⑧ Integrate generous shelters and awnings as part of the station building and entrances to provide weather protection for station users.

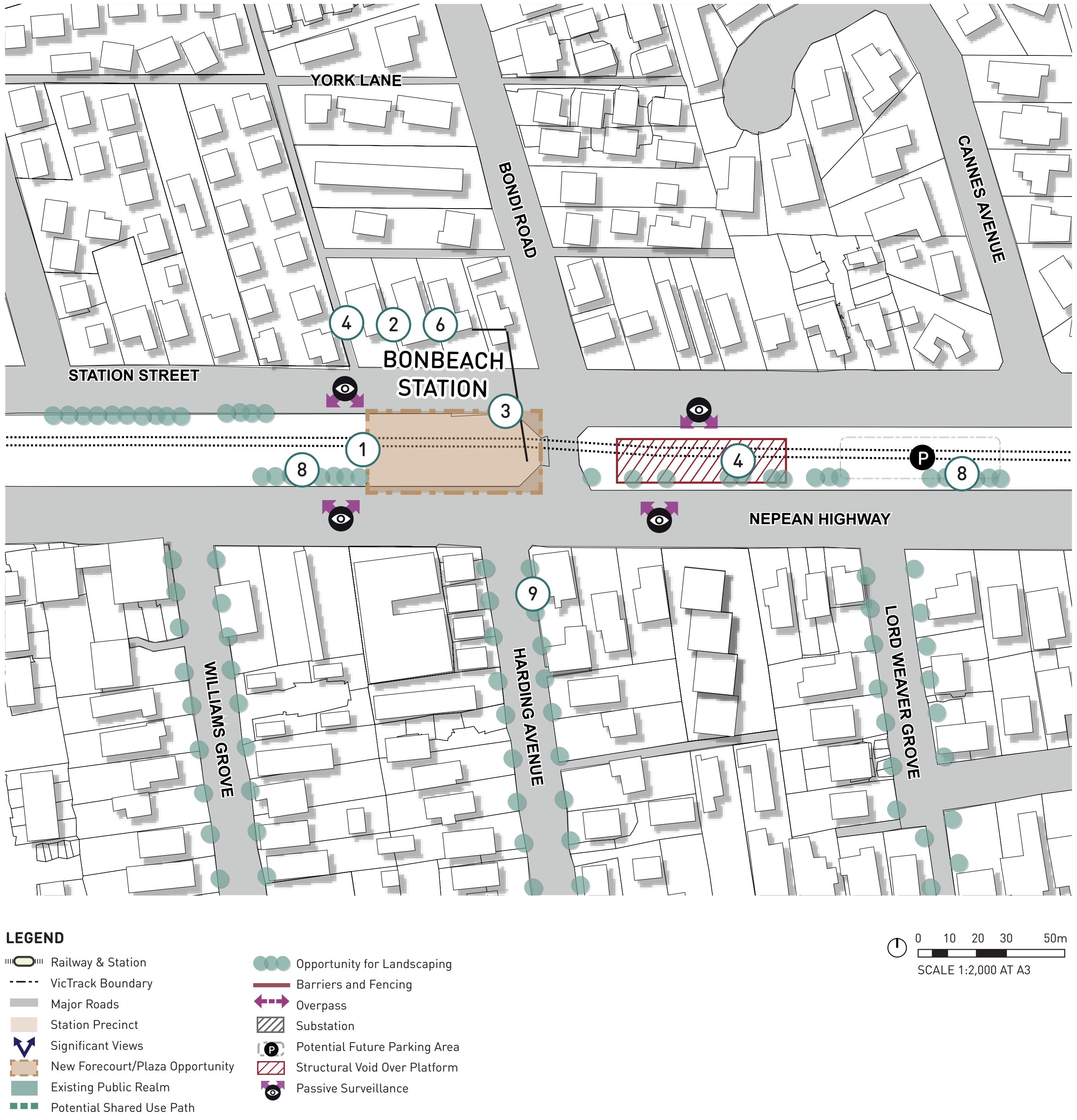
⑨ Provide treatments to the rail cutting that are high quality and visually interesting for rail passengers and station users, and establishes a positive sense of arrival into Bonbeach Station.

⑩ Use tree planting along the road and rail corridor to provide shade and shelter for pedestrian and cycling infrastructure, on both sides of both roads and to car parking.

⑪ Design and detail all pedestrian overpasses to maintain a high level of visibility of users from street level through transparent materials, wide pathways, and clear viewlines.

⑫ Maintain adequate clearances between pedestrian paths and overpasses to traffic lanes along Nepean Highway and provide landscaping and other treatments to provide users with a sense of safety.

Figure 32 - Amenity and Safety Guidelines Enlargement



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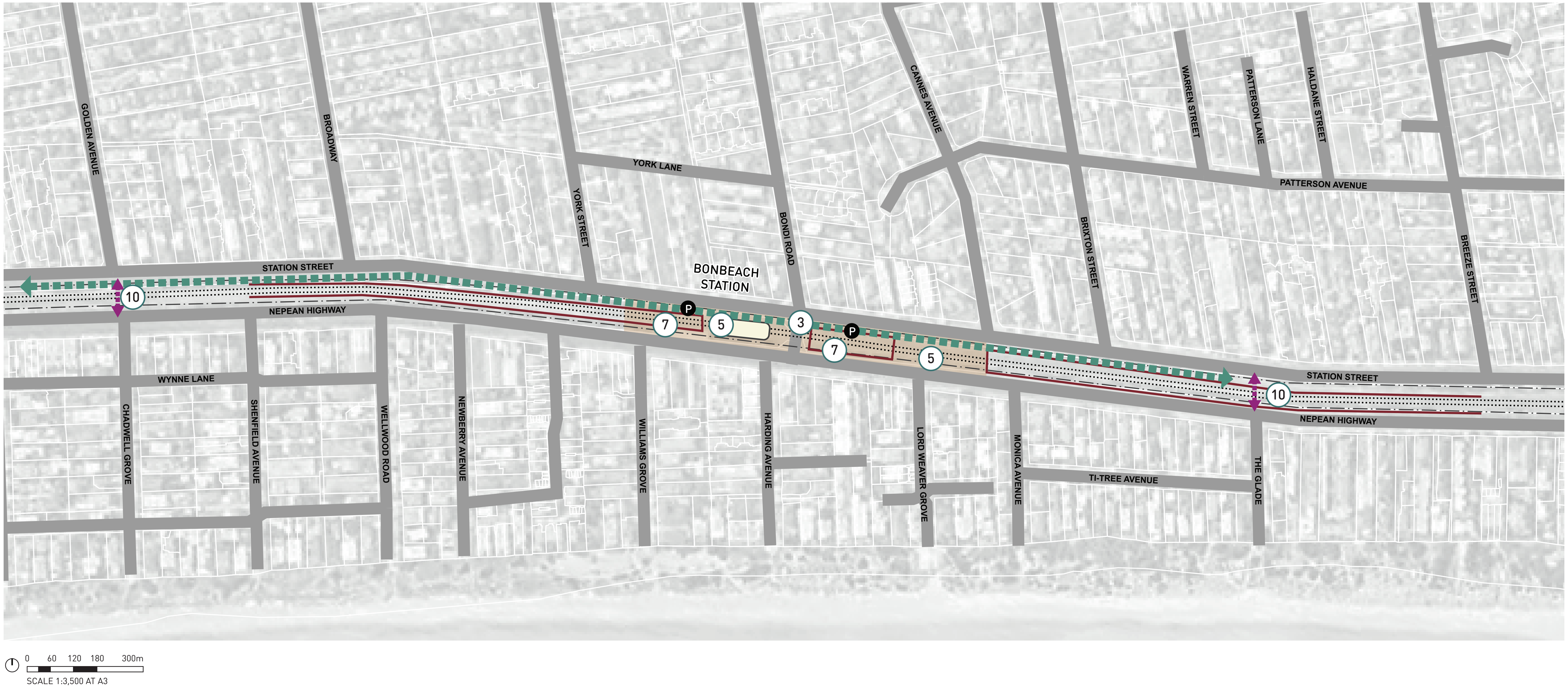
PRINCIPLES

☆ **AMENITY**	High quality urban amenity associated with access to services and the experience of great public places contributes to successful, equitable and prosperous communities.
SAFETY	Safe environments are essential for strong, connected and happy communities.

Figure 33 - Amenity and Safety Guidelines Plan



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6.4 DESIGN GUIDELINES

PRINCIPLE 6: VIBRANCY

STRATEGIC OBJECTIVES

1. LINK THE STATION WITH NEIGHBOURHOOD CENTRE USES

   Enhance the precinct by better integrating the station with the existing uses contained within the neighbourhood centre and to the recreational amenities in the area.

2. PROVIDE A HIGH QUALITY AND FUNCTIONAL PUBLIC REALM

   Create an inclusive and people oriented public realm at the station that supports social interaction and accommodates a range of uses and movements.

GUIDELINES

① Maintain the main station entry in its current location north of Bondi Road to maintain physical and visual links with the existing neighbourhood centre and key beach access point.

② Orient station entry points to Station Street, where key cycling and pedestrian links are provided and vehicle traffic is less predominant, whilst maintaining visual links to activities along Nepean Highway.

③ Enhance pedestrian connectivity and infrastructure between the station precinct and the Bonbeach neighbourhood centre and the foreshore.

④ Ensure that any built form provides a positive address to the Bonbeach neighbourhood activity centre along Nepean Highway, to strengthen the functioning of this local shopping and community hub.

⑤ Minimise inactive and blank walls adjacent to highly pedestrianised areas, including the station plaza and car parking, and to any built form visible from the Bonbeach neighbourhood centre.

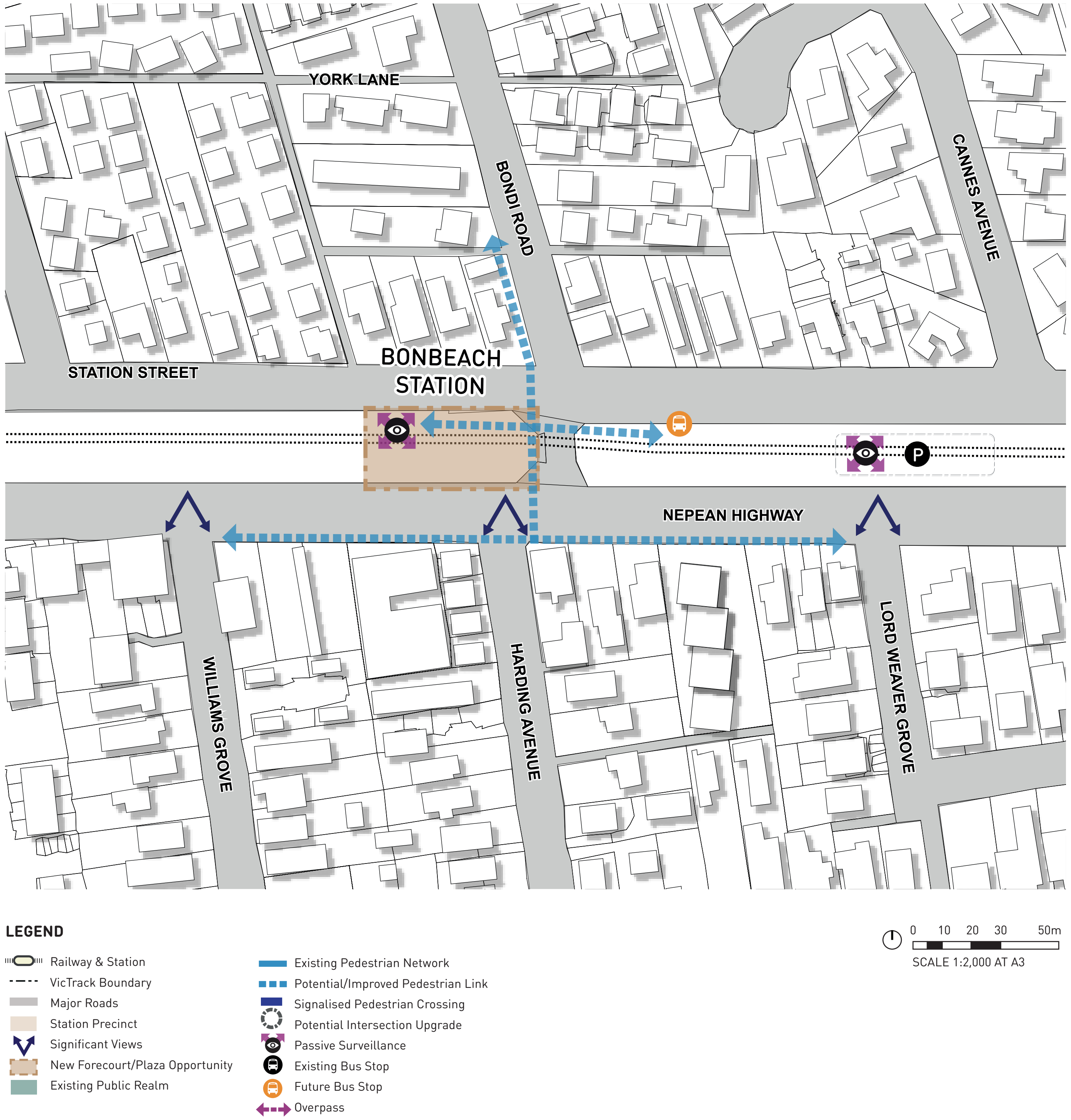
⑥ Minimise the visibility of utilities, infrastructure and back of house functions from the Bonbeach neighbourhood centre, main pedestrian through-paths and gathering areas.

⑦ Provide a suitably generous station plaza space that accommodates public amenities such as seating, lighting, and furniture, in addition to space required for pedestrian and cycle through-paths.

⑧ Orient and design the station kiosk and any staff and customer amenities to maximise passive surveillance over the station plaza, future bus bays, and to pedestrian activity along Station Street.

⑨ Maximise activity at the station entrance by co-locating uses such as kiss and ride, future bus bays, and pedestrian crossings, with the station plaza along Station Street.

Figure 34 - Vibrancy Guidelines Enlargement



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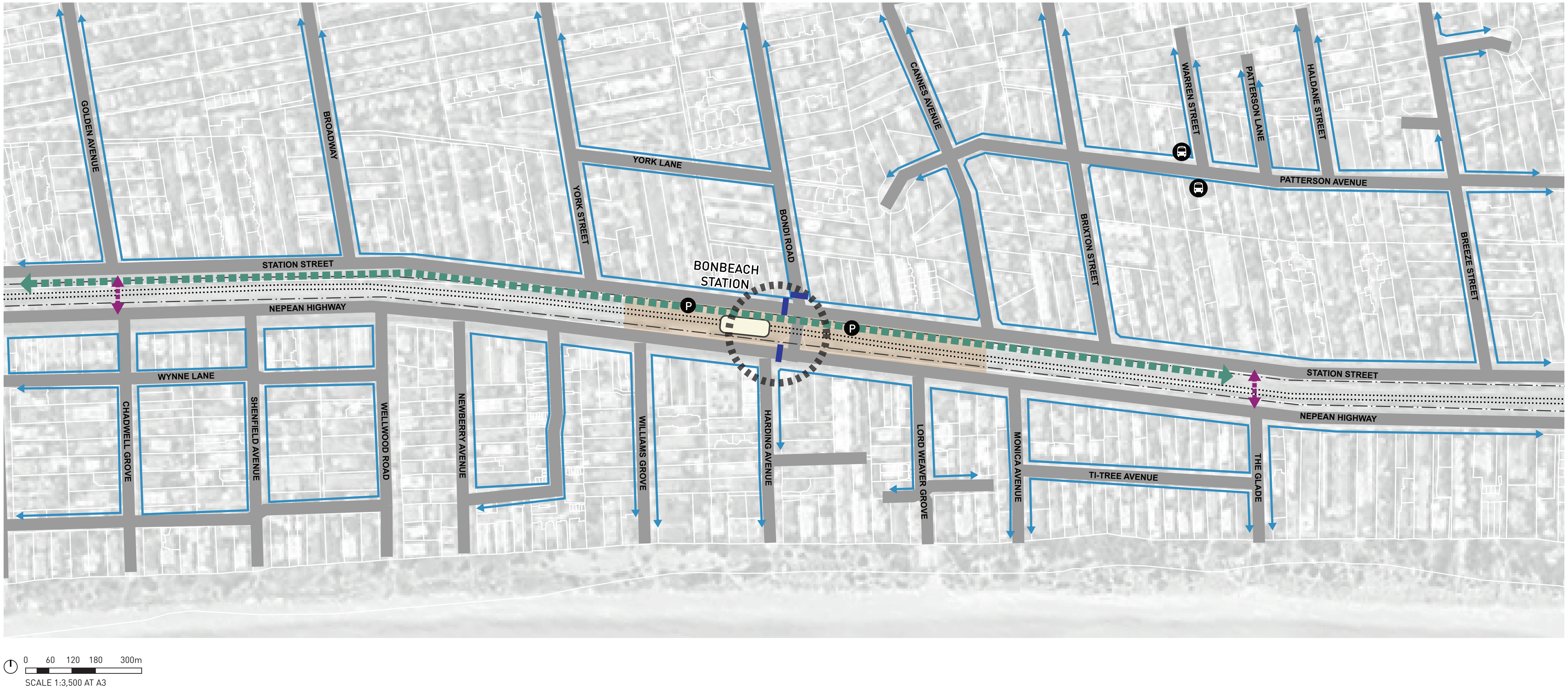
PRINCIPLE

VIBRANCY Animation of key civic spaces, and diversity in the experience of urban places support prosperous and healthy communities.

Figure 35 - Vibrancy Guidelines Plan



WORKING DRAFT - FOR DISCUSSION PURPOSES ONLY

6.4 DESIGN GUIDELINES

PRINCIPLE 4: RESILIENCE AND SUSTAINABILITY

STRATEGIC OBJECTIVES

1. PROMOTE SUSTAINABLE DESIGN

   Ensure the station building and landscaping integrates sustainable design concepts that allow for efficient water, waste and energy use, conservation and re-use.

2. CREATE A SITE RESPONSIVE DESIGN

   Draw on a comprehensive site and context analysis to inform the design of the precinct and landscaping and building details.

3. CREATE A LASTING STATION PRECINCT

   Provide a design that demonstrates a high standard of architectural design and addresses the current and future needs of all users.

GUIDELINES

① Select or incorporate a material palette for the public realm hardscape (footpaths, fences, barriers, walls, paved areas) that is high quality, durable, low maintenance, and minimises opportunities for graffiti and is resilient in the coastal setting.

② Use landscaping species that are appropriate for the specific climactic and environmental conditions of the area such as soil types, wind, temperature, and rain conditions, and the type of physical environment created by the rail infrastructure.

③ Integrate Water Sensitive Urban Design (WSUD) into the stormwater management of the station precinct to maximise the viability of landscape and mitigate heat island effects, and explore opportunities to supply stormwater to the broader precinct.

④ Provide permeable ground surfaces within the station precinct, where possible, for absorption of rainwater and reduction of stormwater run-off.

⑤ Maintain and establish mature and significant landscaping along the rail corridor and in the station plaza to provide shading opportunities and enhance the local habitat and microclimate.

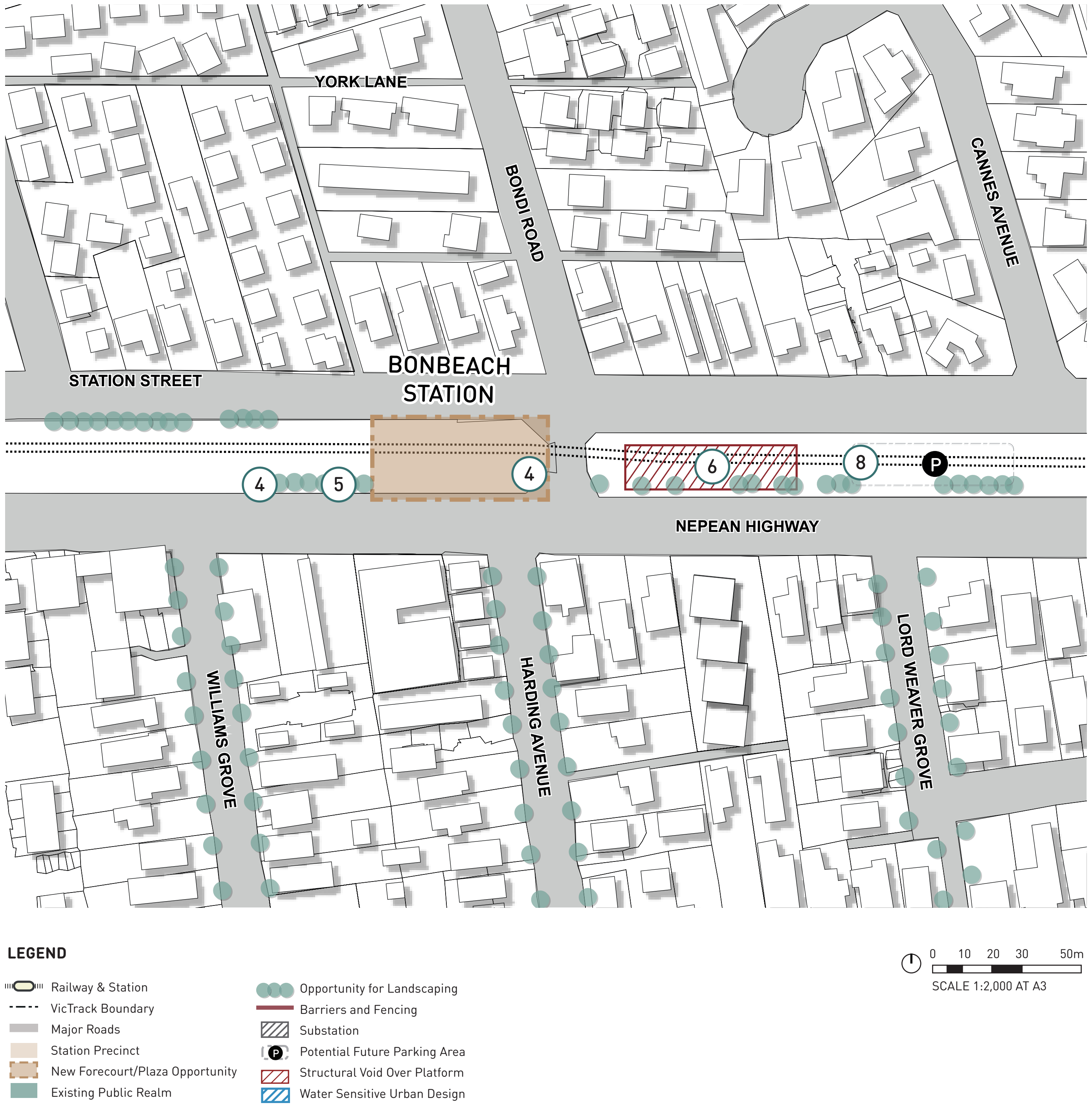
⑥ Use plant species appropriate to the coastal climatic conditions of the area and the limited available root space along the rail.

⑦ Provide a high level of natural daylight to the platforms to minimise reliance on artificial lighting.

⑧ Ensure the design and treatment of the station, plaza area, and walking and cycling paths to allow for future growth in demand and patronage, and flexibility in the modes of transport that rail users will use to reach the station in the future.

⑨ Design for flexibility in the deck structures to accommodate potential changes to what they are used for in the future.

Figure 36 - Resilience and Sustainability Guidelines Enlargement



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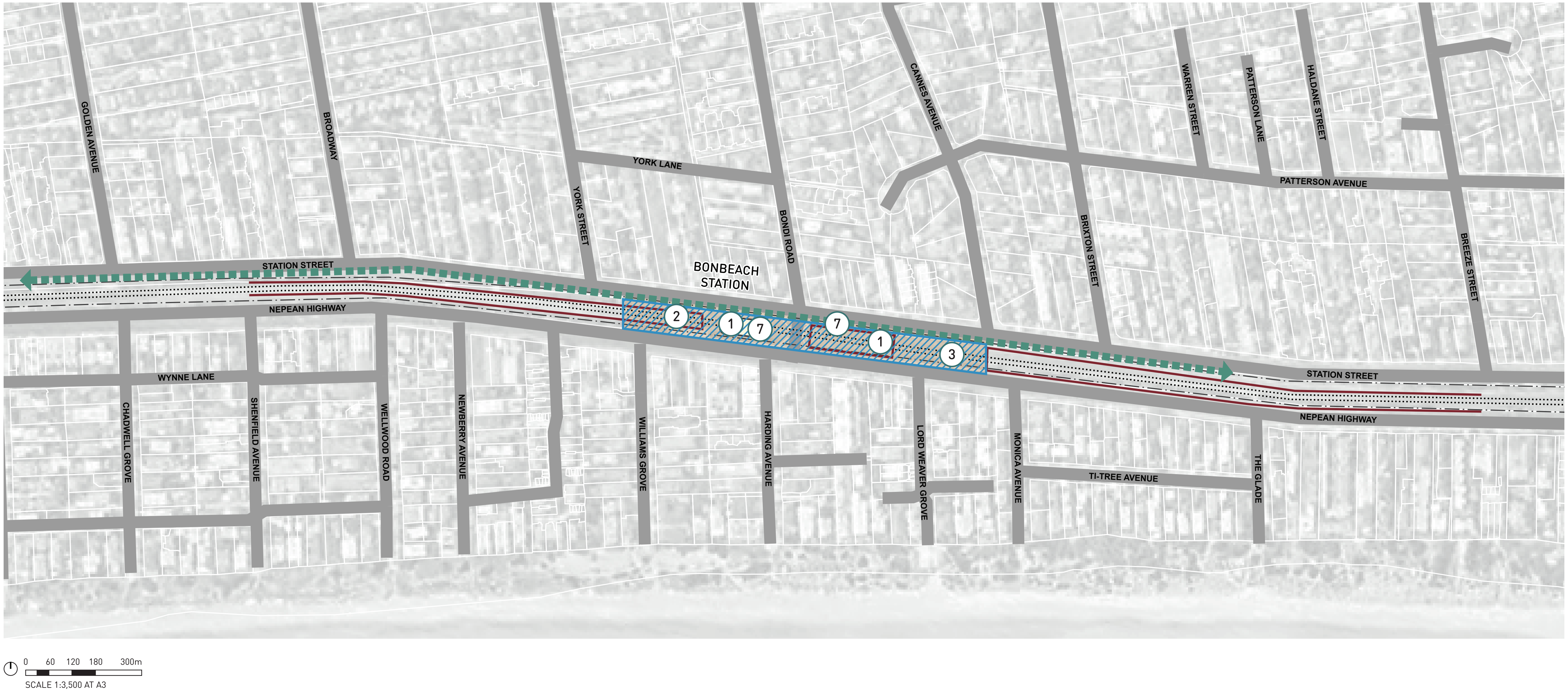
PRINCIPLE

RESILIENCE AND SUSTAINABILITY Places must be sustainable, enduring and resilient in order to support and nurture current and future generations.

Figure 37 - Resilience and Sustainability Guidelines Plan



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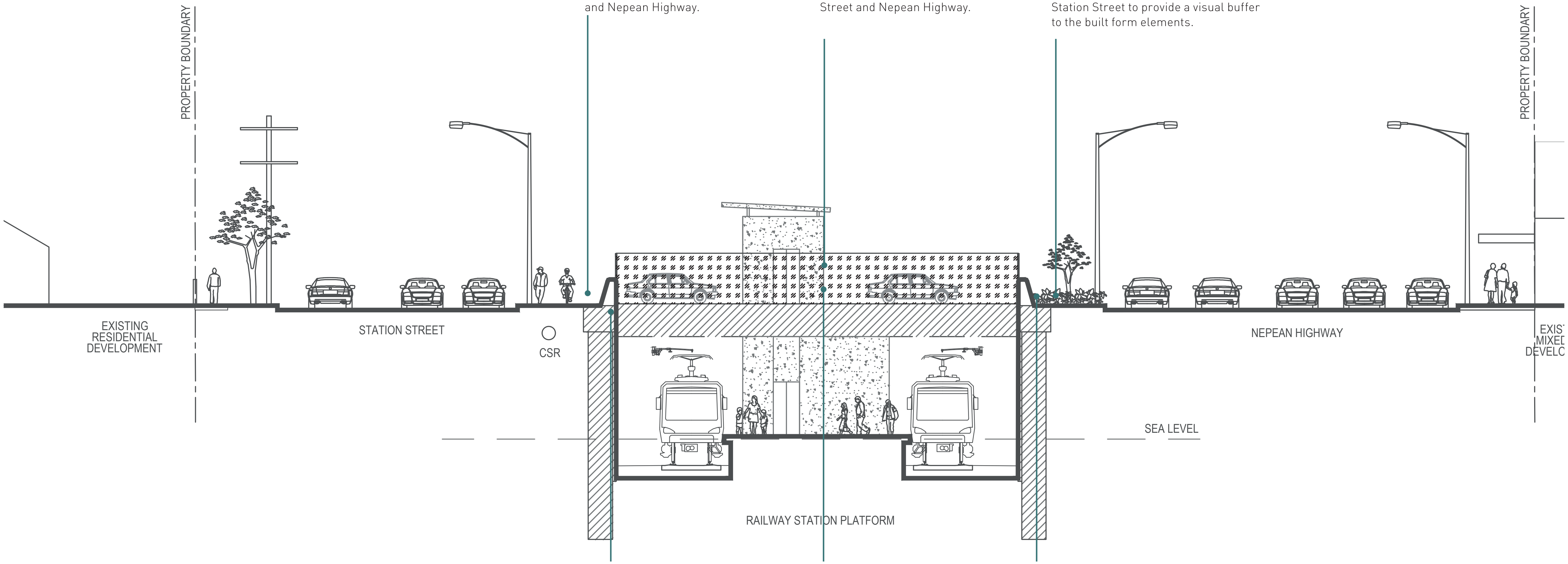
6.5 DESIGN GUIDELINE SECTIONS

A rail under road design solution has been selected for the Bonbeach level crossing removal project. The two cross sections below have been included to illustrate the spatial opportunities and constraints of the rail corridor and the potential interface with the immediately adjacent streets and features.

The cross sections also demonstrate how a rail under road solution can deliver on the design guidance provided in this document.

Figure 38 - Typical Station Platform Section Rail Under



High quality landscaping and fencing treatments can provide positive visual amenity outcomes along Station Street and Nepean Highway.

A large proportion of the platform can be open to the sky to provide passive surveillance opportunities from Station Street and Nepean Highway.

Coastal tree species, shrubs and other landscaping can be reinstated or established along Nepean Highway and Station Street to provide a visual buffer to the built form elements.

Visual connections and transparency between the station platform to the station concourse can be achieved.

The platform environment can be comfortable, well-lit, and inviting and commensurate with an internalised space with high-quality materials on floor, wall and ceiling surfaces.

Treatments to the rail cutting can be high quality and visually interesting for rail passengers and station users and establish a positive sense of arrival into Bonbeach Station.

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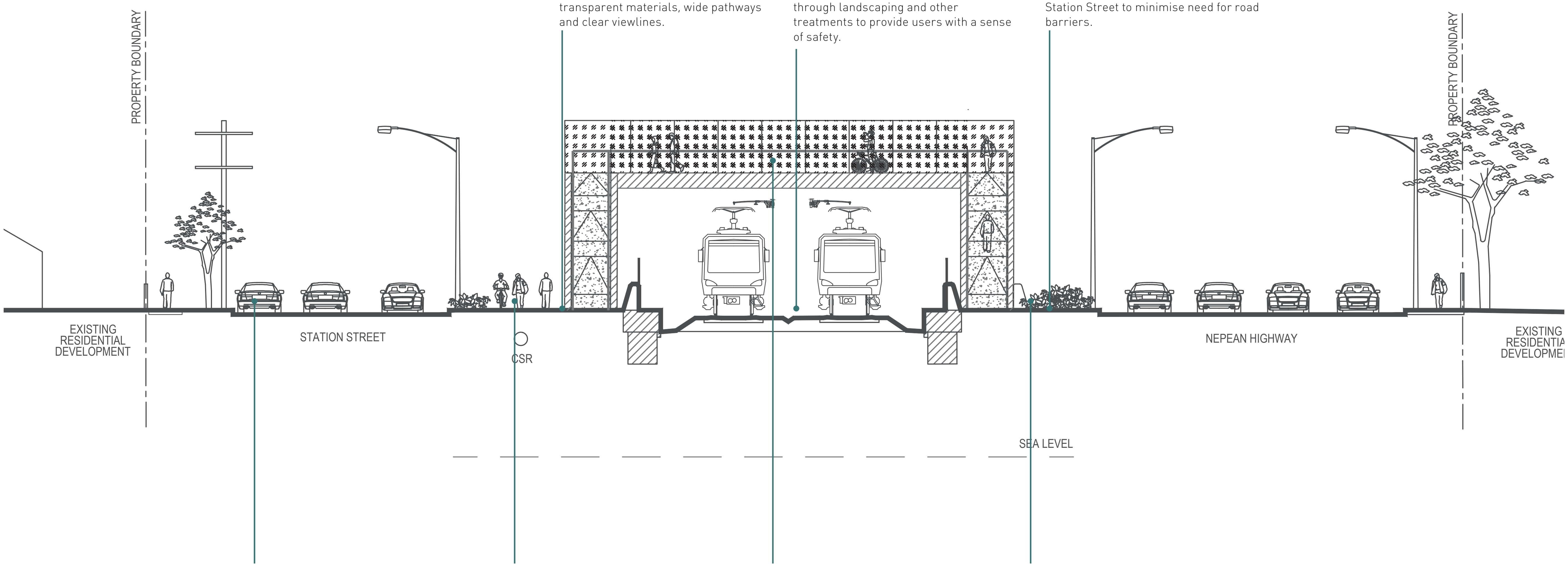
Figure 39 - Typical Overpass Section Rail Under



Pedestrian overpasses can be designed to maintain a high level of visibility of users from street level through transparent materials, wide pathways and clear viewlines.

Clearances between pedestrian paths and overpasses to traffic lanes along Nepean Highway can be provided through landscaping and other treatments to provide users with a sense of safety.

Significant canopy trees can be located outside of VicRoads prescribed clear zones along Nepean Highway and Station Street to minimise need for road barriers.

Indented roadside car parking arrangements along both and Nepean Highway can accommodate street tree planting.

The Station Street side of the corridor can accommodate safe and improved walking and cycling infrastructure along the length of the rail corridor

Fencing, barriers and pedestrian overpasses located along the rail corridor can be designed to contribute to the character and quality of the station building.

Landscaping along the corridor can provide shade and shelter to pedestrian and cycling infrastructure and to car parking.

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APPENDIX

A: GLOSSARY AND REFERENCE LIST

B: URBAN CONTEXT CONSIDERATIONS

C: STRATEGIC PLANNING BACKGROUND INFORMATION

D: DETAILED TRANSPORT PROJECT ANALYSIS

APPENDIX A: GLOSSARY AND REFERENCE LIST

7.1 GLOSSARY

BPR	Bicycle Priority Routes
CBD	Central Business District
DELWP	Department of Environment, Land, Water, and Planning
EES	Environmental Effects Statement
LXRA	Level Crossing Removal Authority
MTM	Metro Trains Melbourne
OVGA	Office of the Victorian Government Architect
PBN	Principal Bicycle Network
PPA	Pedestrian Priority Area
PRS	Project Requirements Specification
PTV	Public Transport Victoria
SPPF	State Planning Policy Framework
SUP	Shared Use Path
TFV	Transport for Victoria
UDAP	Urban Design Advisory Panel
UDF	Urban Design Framework
UDG	Urban Design Guideline
VPA	Victorian Planning Authority
WSUD	Water Sensitive Urban Design

7.2 REFERENCES

AECOM - GHD Joint Venture (2017), Frankston Corridor Urban Design Strategy, Level Crossing Removal Project

AECOM - GHD Joint Venture (August 2016), Urban Design Framework, Level Crossing Removal Project, Version 3

Australian Bureau of Statistics (2011 and 2016), Census QuickStats

Chief Parliamentary Counsel (July 2017) Planning and Environment Act 1987, Version 130

City of Kingston (October 2017), Kingston Planning Scheme, Clause 21, Planning Zones, and Planning Overlays

City of Kingston (2016), Prosperous Kingston: A Framework for Economic Sustainability

City of Kingston (2014), Kingston Residential Strategy Update

City of Kingston (2007), Kingston Neighbourhood Character Guidelines

City of Kingston (2009), Kingston Cycling and Walking Plan

City of Kingston (2006), City of Kingston Retail/Commercial Development Strategy

Public Transport Victoria (2012), Network Development Plan - Metropolitan Rail

The State Government of Victoria: Department of Environment, Land, Water, and Planning (2017), Plan Melbourne 2017 - 2050

The State Government of Victoria: Department of Environment, Land, Water, and Planning (2017), State Planning Policy Framework, Clause 9 to Clause 19

VicRoads (2012), Principal Bicycle Network (PBN) and Bicycle Priority Routes (BPR)

Public Transport Precincts, Design Requirements and Guidance, PTV

Sustainability Policy, Level Crossing Removal Authority

Transport Integration Act 2010

Urban Design Framework, Level Crossing Removal Authority

Victorian Urban Design Charter 2009

Creating Places for People, Australian National Urban Design Protocol

Creative Strategy Guidelines, Level Crossing Removal Authority

Good Design and Transport, Issue 05, Office of the Victorian Government of Architects

VicRoads (July 2011), SmartRoads: Connecting Communities

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7.3 FIGURE SOURCES

#	FIGURE	REFERENCE
1	Level Crossing Removal - Project Map	Level Crossing Removal Project
2	Urban Design Briefing Documents	AECOM - GHD Joint Venture (2017)
3	Methodology	AECOM - GHD Joint Venture (2017)
4	Urban Design Framework	AECOM - GHD Joint Venture (2017)
5	Regional Context Map	AECOM - GHD Joint Venture (2017)
6	Historical Timeline	AECOM - GHD Joint Venture (2017)
7	Land Use Analysis Plan	AECOM - GHD Joint Venture (2017)
8	Land Use Analysis Enlargement	AECOM - GHD Joint Venture (2017)
9	Built Form and Heritage Analysis Plan	AECOM - GHD Joint Venture (2017)
10	Built Form and Heritage Analysis Enlargement	AECOM - GHD Joint Venture (2017)
11	Transport Networks and Access Analysis Plan	AECOM - GHD Joint Venture (2017)
12	Transport Networks and Access Analysis Enlargement	AECOM - GHD Joint Venture (2017)
13	Geomorphological Map of Area	AECOM - GHD Joint Venture (2017)
14	Transport Networks and Access Analysis Plan	AECOM - GHD Joint Venture (2017)
15	Transport Networks and Access Analysis Plan	AECOM - GHD Joint Venture (2017)
16	Key Map - Bonbeach Statistical Area	AECOM - GHD Joint Venture (2017)
17	Population Profile and Growth Projections	AECOM - GHD Joint Venture (2017)
18	Dwelling Profile and Growth Projections	AECOM - GHD Joint Venture (2017)
19	Dwelling Profile Comparative Analysis	AECOM - GHD Joint Venture (2017)
20	Modal Share Comparative Analysis	AECOM - GHD Joint Venture (2017)
21	Key Map - Bonbeach Photographic Survey	AECOM - GHD Joint Venture (2017)
22	Engagement Phases	AECOM - GHD Joint Venture (2017)
23	Community Consultation Snapshot	AECOM - GHD Joint Venture (2017)
24	Issues and Opportunities Analysis	AECOM - GHD Joint Venture (2017)
25	Urban Design Guidelines Structure	AECOM - GHD Joint Venture (2017)
26	Urban Contexts	AECOM - GHD Joint Venture (2017)
27	Bonbeach Strategic Objectives Overview	AECOM - GHD Joint Venture (2017)
28	Identity and Urban Integration Guideline Enlargement	AECOM - GHD Joint Venture (2017)
29	Identity and Urban Integration Guideline Plan	AECOM - GHD Joint Venture (2017)
30	Accessibility, Connectivity and Wayfinding Guideline Enlargement	AECOM - GHD Joint Venture (2017)
31	Accessibility, Connectivity and Wayfinding Guideline Plan	AECOM - GHD Joint Venture (2017)
32	Safety and Amenity Guideline Enlargement	AECOM - GHD Joint Venture (2017)
33	Safety and Amenity Guideline Plan	AECOM - GHD Joint Venture (2017)
34	Vibrancy Guideline Enlargement	AECOM - GHD Joint Venture (2017)
35	Vibrancy Guideline Plan	AECOM - GHD Joint Venture (2017)
36	Resilience and Sustainability Guideline Enlargement	AECOM - GHD Joint Venture (2017)
37	Resilience and Sustainability Guideline Plan	AECOM - GHD Joint Venture (2017)
38	Typical Station Platform Section Pail Under	AECOM - GHD Joint Venture (2017)
39	Typical Overpass Section Rail Under	AECOM - GHD Joint Venture (2017)
40	Regional Planning Zones	AECOM - GHD Joint Venture (2017)
41	Regional Planning Overlays	AECOM - GHD Joint Venture (2017)
42	Proposed Pedestrian Circulation	AECOM - GHD Joint Venture (2017)
43	Proposed Cyclist Circulation	AECOM - GHD Joint Venture (2017)
44	Bonbeach Road Proposed Road Layout	AECOM - GHD Joint Venture (2017)

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7.4 IMAGE SOURCES

#	IMAGE	REFERENCE
1	Edithvale - Seaford Wetlands	Frankston City Libraries (1866) Carrum Swamp in the County of Mornington map, Accessed October 13, 2017 < https://www.flickr.com/photos/39368267@N02/8743824436>
2	Patterson River Artificial Channel	Wayne Knoll (2015) The in-train from Frankston heading for Black's Crossing & Chelsea as it crosses the Patteron River, Accessed October 13, 2017 <http://unkalfredhenryhollisdiary1935.blogspot.com.au/>
3	Bonbeach Station	Vic Rail Stations (2016) Down platform station building, Accessed October 13, 2017 <http://www.vicrailstations.com/Stony_Point/Bonbeach/Bonbeach.html>
4	Patterson River Bridge Upgrade	Victorian Places (2015) Patterson River Bridge, Bonbeach, 1938, Accessed October 13, 2017 <http://www.vicrailstations.com/Stony_Point/Bonbeach/Bonbeach.html>
5	Residential Growth	Victorian Places (2015) Patterson River Golf Links, Club House, Bonbeach, 1938, Accessed October 13, 2017 <http://www.victorianplaces.com.au/node/64520>
6	Bonbeach Life Saving Club	Bonbeach Life Saving Club Inc. (2017) Bonbeach Life Saving Club, Accessed October 13, 2017 <http://bonbeachlsc.com.au/>
7	Existing Cafés and Retail on Nepean Highway	Weekend Notes (2013), Bonbeach Cafe, Accessed October 13, 2017 <https://www.weekendnotes.com/bonbeach-cafe/>
8	Bonbeach Residential Care and Nursing Home	ACSA Group (2016), Bonbeach Nursing Home, Accessed October 12, 2017 <http://www.acsagroup.com.au/facilities/our-aged-care-facilities/bonbeach>
9	3 Lord Weaver Grove	Google Streetview (2015) 3 Lord Weaver Grove, Accessed October 13, 2017 <https://www.google.com.au/maps/@-38.0647127,145.119088,3a,75y,322.83h,89.07t/data=!3m6!1e1!3m4!1sz5mORyimSLE7Nj9XzP7PDg!2e0!7i13312!8i6656?hl=en-AU>
10	Patterson River Country Club	Visit Victoria (2017), Patterson River Golf Club, Accessed October 13, 2017 <http://nepeancountryclub.com.au/>
11	Bonbeach Boat Sheds	Weekend Notes (2013), Boat Houses on the Bonbeach foreshore, Access October 13, 2017 <https://www.weekendnotes.com/williams-grove-carpark-bonbeach/>
12	Station Street/Bondi Road Level Crossing	Urban Analyst (2017) The existing level crossing at Bondi Road, Bonbeach/Level Crossing Removal Authority, Accessed October 13, 2017 < http://www.urbanalyst.com/in-the-news/victoria/4368-environmental-effects-statement-required-for-level-crossing-removals-at-edithvale-and-bonbeach.html>
13	Existing Station Platforms	Mapio (2017) Bonbeach, Accessed October 13, 2017 <http://mapio.net/pic/p-17878150/>
14	Bonbeach Station Nepean Highway Access	AECOM - GHD Joint Venture (2016)
15	Patterson River Country Club Golf Course	Pacific Coast Design (2017) Patterson River Country Club - Bonbeach, Melbourne, Accessed October 13, 2017 <http://golf-designers.com/pcd/patterson-river-country-club-bonbeac-victoria>
16	Edithvale - Seaford Wetlands	Visit Victoria (2017), Patterson River Golf Club, Accessed October 13, 2017 <http://nepeancountryclub.com.au/>
17	Nepean Highway Looking South	AECOM - GHD Joint Venture (2016)
18	Nepean Highway Looking North	AECOM - GHD Joint Venture (2016)
19	Harding Avenue towards Port Phillip Bay	AECOM - GHD Joint Venture (2016)
20	Station Street Looking North	AECOM - GHD Joint Venture (2016)
21	Station Street Looking North	AECOM - GHD Joint Venture (2016)
22	Bonbeach Station Pedestrian Ramp, Station Street Looking South	AECOM - GHD Joint Venture (2016)
23	Bonbeach Station, Nepean Highway Looking South	AECOM - GHD Joint Venture (2016)
24	Station Street Looking South at Level Crossing	AECOM - GHD Joint Venture (2016)
25	Station Street Looking North from Station	AECOM - GHD Joint Venture (2016)
26	Existing Level Crossing, Looking East	AECOM - GHD Joint Venture (2016)
27	Commercial Development along Nepean HIghway	AECOM - GHD Joint Venture (2016)

7.5 TABLE SOURCES

#	TABLE	REFERENCE
1	Urban Design Considerations for Different Urban Contexts	AECOM - GHD Joint Venture (2017)

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APPENDIX B: URBAN CONTEXT CONSIDERATIONS

Table 1: Urban Design Considerations for Different Urban Contexts

URBAN DESIGN PRINCIPLES	1. IDENTITY	2. URBAN INTEGRATION	3. ACCESSIBILITY	4. CONNECTIVITY & WAYFINDING	5. SAFETY	6. AMENITY	7. VIBRANCY	8. RESILIENCE & SUSTAINABILITY
1. STATION PRECINCT	• Station built form design • Functional station design • Forecourt and entry • Public art and creative works • Landscape design • Heritage	• Station facility integration	• Suitable accessibility for all modes based on modal hierarchy • Equitable / universal access • Service and emergency access	• Station facilities (park'n'ride, kiss'n'ride, taxi access) • Intermodal connectivity • Bus interchange • Pedestrian and cycle routes • Vehicular access • Fences and barriers	• Safety in design requirements (CPTED) • Sight lines • Passive surveillance of station and station facilities	• Visual amenity – built form and landscape quality and character • User comfort (shelters, station access) • Station forecourt or plaza spaces. • Fences and barriers	• Station forecourt or plaza • Station facilities and non-transit land uses • Public art and creative works	• Sustainable built form and landscape design • Sustainability certification (green star rating) • Water sensitive urban design • Lighting design • Material durability and maintenance requirements • Vegetation loss and environmental impact
2. TRANSITION ZONE	• Interfaces with station precinct • Visual integration • Streetscape design • Public realm / public spaces • Built form character and heritage	• Development potential surrounding station • Urban renewal opportunities • Future proofing considerations • Integration between station and activity centre	• Pedestrian and cycle routes • Local road movements and impact on property and/or business access	• Development potential surrounding station • Urban renewal opportunities • Future proofing considerations • Integration between station and activity centre	• Visual connectivity and passive surveillance • Sight lines and safety in design for key movement routes	• Built form and landscape quality and character • Streetscape amenity • Fences and barriers	• Relationship with nearby activities / activity centre • Activation of spaces adjacent to station • Streetscapes	• Water sensitive urban design • Lighting design • Vegetation loss and environmental impact • Pollution mitigation
3. CORRIDOR AND THE WIDER PRECINCT	• Interfaces with corridor • Built form and corridor landscape character • Heritage	• Future road / rail network upgrades	• Access and connectivity within and across the corridor	• Future road/rail network upgrades	• Promote active transport and safe places	• Built form and corridor landscape character	• Key local activities and connectivity	• Natural heritage and biodiversity

(adapted from VicRoads Framework)

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APPENDIX C: STRATEGIC PLANNING BACKGROUND INFORMATION

CHARTER KECK CRAMER
Strategic Property Consulting

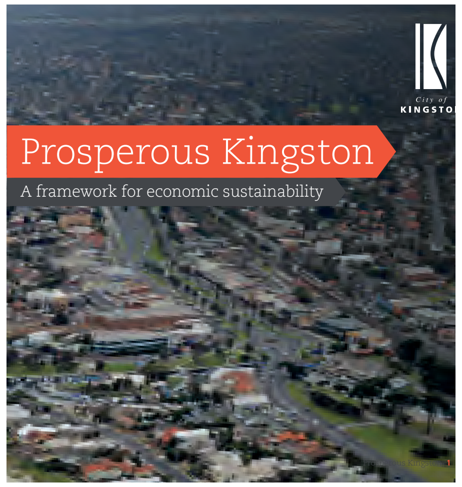
Retail / Commercial Development Strategy

City of Kingston
In association with
Charter Keck Cramer and
Hansen Partnership

Final Report

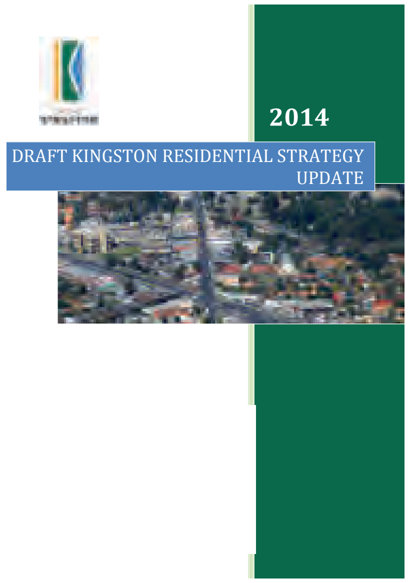
Prepared for
City of Kingston

July, 2006


City of KINGSTON

Prosperous Kingston

A framework for economic sustainability


2014

DRAFT KINGSTON RESIDENTIAL STRATEGY UPDATE

Neighbourhood
Character
Guidelines

City of KINGSTON

MAY 2000, REVISED AUGUST 2007
- revision to Character Area 4.

2009 – 2013
KINGSTON CYCLING AND WALKING PLAN

Prepared by Kingston City Council
August 2008

TITLE	City of Kingston Retail/Commercial Development Strategy	Prosperous Kingston – A Framework for Economic Sustainability	Kingston Residential Strategy Update	Kingston Neighbourhood Character Guidelines	Kingston Cycling and Walking Plan
YEAR	2006		2014	2000, revised August 2007	2008
SUMMARY	This policy was developed to help guide future direction of retail, commercial and office investment in the City of Kingston. The policy identifies public transport access and quality as an important factor in commercial area development and that where possible, opportunities to increase public transport mode share should be maximised.	This policy recognises that the prosperity of the Kingston community is tied to the ability of the local economy to prosper and generate sustainable development. Access to a high quality integrated transport system that meets the needs of businesses and residents is seen as vital in maintaining and improving the economic prosperity of the municipality.	The policy is an update to the Kingston Residential Strategy 2000 which was prepared to address residential development within Kingston. The strategy proposes that there will be residential consolidation and increased densities along major arterial roads such as Nepean Highway and close to public transportation (close to Bonbeach Railway Station).	The Kingston Neighbourhood Character Guidelines have been designed to identify different neighbourhood characters found within the diverse residential areas in Kingston and to provide guidance for residential development relevant to the neighbourhood character of each area. The typical neighbourhood characteristics found in Landscape Character Areas relevant to the Bondi Road, Bonbeach level crossing are of one to two storey, detached dwellings.	This policy recognises the importance of walking and cycling in Kingston and advocates for increased pedestrian and cycling infrastructure, including dedicated paths or lanes and improved signage in order to meet local needs and demands.
KEY SECTIONS	Whole document	Whole document	Planning Area Residential Frameworks within the strategy address residential land use issues at localised sites. The Bondi Road, Bonbeach level crossing is located within Planning Area 9 of this policy.	Whole document	Whole document

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Figure 40 - Regional Planning Zones

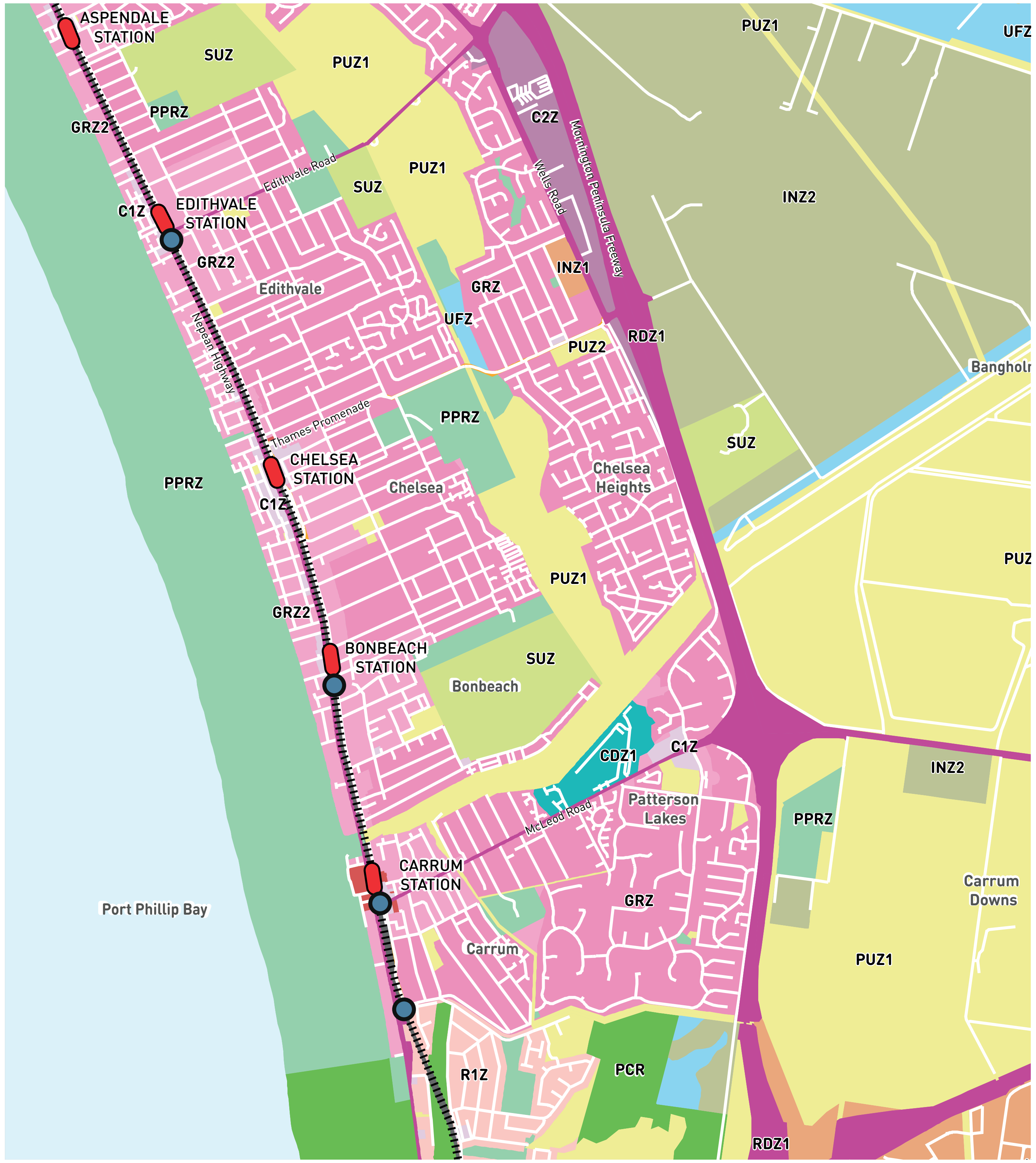
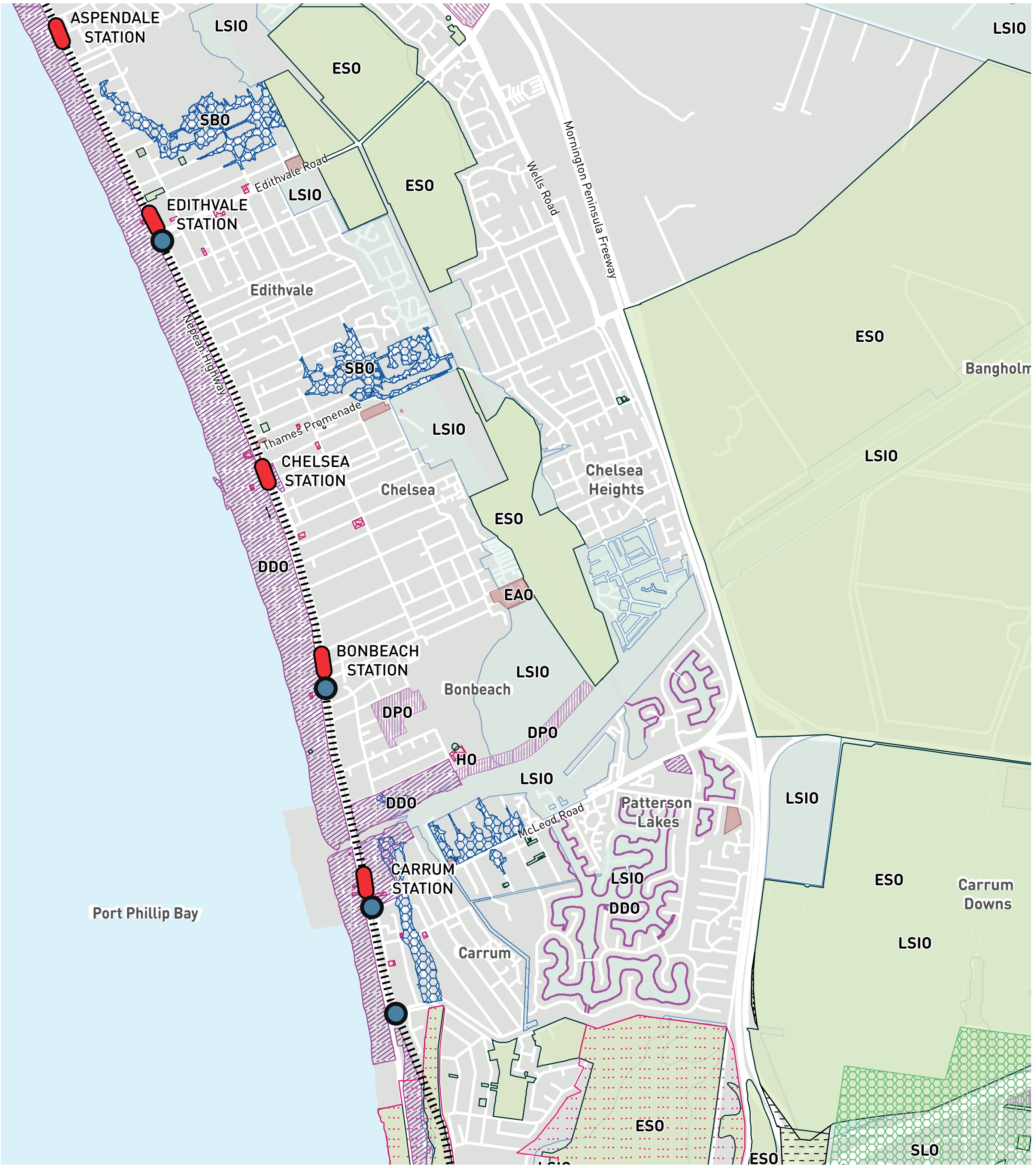


Figure 41 - Regional Planning Overlays



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